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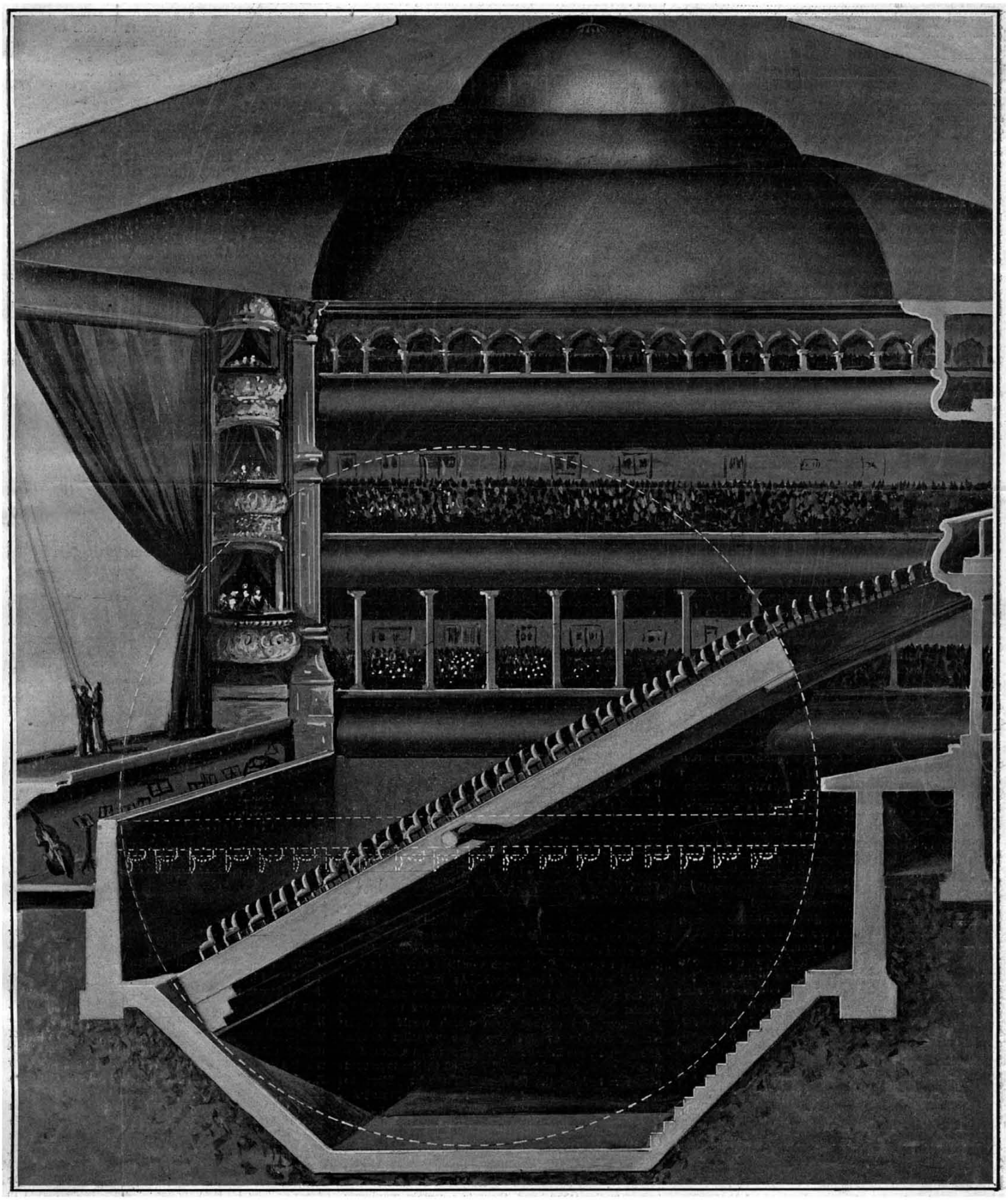
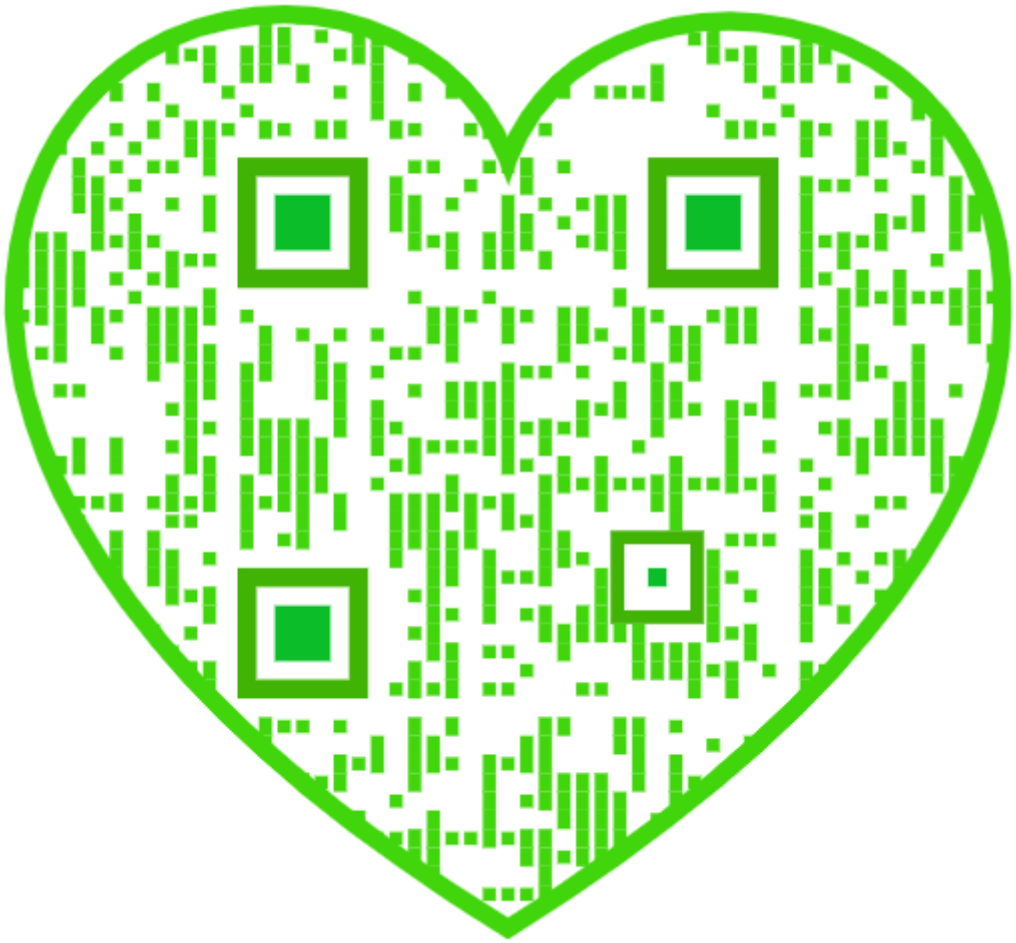


A THEATER AUDITORIUM WITH A ROTATABLE FLOOR PERMITTING OF ITS CONVERSION INTO A DANCING HALL.—[See page 391.]



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NEW YORK, SATURDAY, MAY 11, 1907.

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

THE PERIL OF THE DERELICT.

The safeguards of science and good engineering have been thrown so carefully around the transatlantic passenger, that travel by sea is decidedly safer than travel by land. One by one the perils of the deep have been removed or so far controlled that the chances of a passenger who embarks at New York, setting foot safely and unhurt, and within a few days' time, on European soil are shown by statistics to be so many millions to one. The risk of collision has been largely eliminated by the selection of separate specified lines of travel to which the ships can, and do, adhere with wonderful accuracy. Even should collision occur, the vessels are so minutely subdivided that the damage is localized and foundering is a remote possibility. Wireless telegraphy, submarine bells, improved sirens, and many ingenious and effective devices, combine to guide a transatlantic liner to port with an accuracy, which can only be impaired by negligence or carelessness, happily very rare, on the part of the navigating staff.

There is one menace of the deep, however, which, from its very nature, can never be controlled. It may lurk in the path of any unsuspecting vessel, unheralded, scarce detectable by day, quite invisible by night—a menace which may be created by any storm that blows. We refer to the derelict, or the partially submerged hull of a vessel that has been wrecked and abandoned on the high seas. Until a derelict has been sighted and reported by some passing vessel, its very existence is unknown, and even after it has been reported and ships have been warned as to its whereabouts and probable course, its place on the chart can be only approximately determined. While daylight lasts, if a sharp lookout be kept, a ship may sight the semi-submerged craft in time to avoid collision; but by night the question of hitting or missing is one of the merest chance. The only safeguard against the derelict is to find and destroy it; and from time to time the government, on being notified of the existence of dangerous floating wrecks, details a warship to search for and blow up or sink them.

Shipping men on both sides of the Atlantic have been much gratified by the announcement that the Treasury Department is asking for bids for the derelict destroyer which was authorized by the last Congress. This vessel, which is to be stationed on the North Atlantic, will embody the latest improvements in craft of her kind, and will be capable of cruising for five thousand miles without replenishing her bunkers. She will be furnished with powerful searchlights and a wireless telegraph equipment, the latter to enable her to receive and give information as to the location of derelicts. She will be provided with an ammunition room stored with high explosives for sinking and blowing to pieces floating hulls and wreckage; provision being made, as in warships, for flooding the magazines in an emergency. The derelict destroyer will also be furnished with an equipment designed to assist her in salvage and life saving work, for which her size and the fifteen hundred horse-power of her engines will render her highly efficient.

THE LIMITS OF HEAVY ELECTRIC TRACTION.

The progress of the electrification of the terminals and the suburban service of the New York Central and Pennsylvania Railroads has advanced to a point where it becomes possible to make some definite statements as to cost and practicability. Enough has been learned to make it certain, in the minds of some of the engineers associated with the carrying out of the work, that the field of electric traction on steam roads will, for the present at least, be a limited one. Such, at any rate, is the view of Mr. George Gibbs, Chief Engineer of the Electrical Division of the Pennsylvania, New York, and Long Island Railroad, as announced at a recent meeting of the New York Railroad Club.

At present our trunk-line service is worked by heavy and comparatively infrequent train units; and unless the introduction of electric traction increases the capacity of the lines and builds up new business, and the savings in cost are such as to pay for its introduction, Mr. Gibbs believes that its use is "neither logical nor probable." In the first place, it appears that the cost of installing electric traction on steam railway lines has been almost invariably underestimated. In addition to the cost of equipping the line with its purely electrical features, it is necessary, because of that equipment, to make very serious changes in the structure and equipment of the road; so much so, that in some cases these amount to a practical rebuilding of the line. So great are these incidental expenses, that the purely electrical features involved in changing a railroad from steam to electric traction amount, under average conditions, to from one-half to two-thirds of the total cost. From the above statements and others of a like character which have appeared of late in the technical press, it would seem that the remarkable efficiency shown on the electrified elevated roads in this city caused both steam railroad men and electrical engineers to jump to somewhat hasty conclusions as to the economy that would be realized by applying electric traction to trunk lines for long-distance service. As a matter of fact, Mr. Gibbs is of the opinion that electric traction cannot at present be made to show sufficient economy over steam in trunk-line service to justify its wholesale introduction. He states that the public has little idea of the very high cost of inaugurating electric traction. To the railway engineers who have looked into the question with the idea of making the change of motive power, the figures have been "positively staggering."

The experience thus far gained indicates that the introduction of electricity on steam railroads will be confined, for the present at least, to large city terminals where, by abolishing a large amount of the switching, the daily capacity for trains will be greatly increased. It will also be applicable to those sections of the mountain divisions on which the heavy grades occur, provided always that either water power or cheap fuel is available. The electric locomotive, because of its great tractive power, is particularly suited to the handling of trains over heavy grades, and it will prove to be exceedingly valuable in increasing the weight of the ruling trainloads over any given division.

According to this authority the time is far distant when we shall be ready to discard the steam locomotive even to an appreciable extent for heavy, long-distance freight and passenger service. Moreover, he makes the rather startling announcement that when the time does come, it will be brought about through a radical change in methods from any of those heretofore advanced. All of this must not, however, be taken to indicate that any doubt is thrown upon the success of the work which is now being carried out on the New York Central and Pennsylvania Railroads. The benefits in comfort, cleanliness, speed, and safety which were aimed at, undoubtedly will be fully realized; but for the present at least it is probable that the electric zone on the respective roads will not be extended beyond the limits of the more remote suburban service.

TURBO-ELECTRIC ENGINES FOR SHIPS?

The reciprocating steam engine has apparently reached the limit of its efficiency in the propulsion of ocean-going ships. The present indications are that the marine engine of the future will be either the steam turbine or the perfected producer-gas engine; with a strong probability that the latter, because of its excellent fuel economy, will be the preferred type.

There is, however, a third system of propulsion which theoretically, at least, has so much to recommend it that we should not be surprised to see it given a trial in one of the arger ships. We refer to the use of a turbo-electric plant of the same general character as that which is giving such excellent service in stationary power houses ashore. As installed in the engine room of a large steamship the system would consist of steam turbines, direct-connected to electric generators, the current from which would operate motors directly coupled upon the propeller shafts. Although at the first blush this looks like a complication of parts, the advantages derived in the increased efficiency both of the turbines and the propellers, to say nothing of other gains, would under certain conditions render such a plant superior to the present direct turbine drive. This will be evident from the following considerations:

If the turbines on an ocean liner are run at the high speed of revolution which gives the best steam efficiency, this speed will be too great for the propellers. On the other hand, there is a certain maximum speed, beyond which propellers suitable to the propulsion of a large ship cannot be driven efficiently. From the horns of this dilemma the naval architect has sought escape by the only road open to him—that of compromise. Consequently, in the largest turbine-propelled ships of to-day, the turbines are too large and heavy and too slow, and the propellers are too small and running too fast to give their respective best results.

The conflicting requirements of the turbine and the propeller may be harmonized by the interposition between them of the electric generator. This can be done by using small, high-speed, steam turbines direct-connected to generators, these turbo-generators being run at the speed which gives the most economical results. From the generators, current would be led to motors, whose type and speed of revolution would be accommodated to the propellers on the outboard end of the respective shafts. It is evident that by this arrangement both at the steam end and the propeller end the designer would have a perfectly free hand, and in shape, size, speed, etc., he would be able to design directly for the work to be done and, therefore, for the highest efficiency results. Of course, in a plant of this kind there would be a certain loss in the conversion from steam to electric power; but this has been reduced to such a low figure, that it would be more than offset by the increased efficiency of the turbines and propellers and by the great reduction in the sizes and weights of the turbines.

Incidentally there would be various valuable advantages secured. It would be possible, in the case of warships, to cruise at low speed economically, and it would be no longer necessary to provide separate cruising turbines. It would be possible to reverse immediately; and the go-astern turbines would, therefore, also be eliminated. Furthermore, the steam turbines could be located quite independently of the position of the propeller shafts, and might be carried on an upper deck immediately above the propeller-shaft motors. We understand that the problem, as we have outlined it above, has been receiving careful consideration from some of the manufacturers of turbine and electric plants. The only discouraging feature, in any proposed experimental work that might be done, is that a comparative test, to be of any value, must necessarily be carried on in an ocean-going ship of the larger size, since it is only in the larger ships that the reduction of turbine speed becomes a serious drawback.

THE SPRING MEETING OF THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS.

The spring meeting of the American Society of Mechanical Engineers will be held in Indianapolis, Indiana, from May 28 to May 31. The headquarters room will be on the parlor floor of the Claypool Hotel, and the professional sessions on the top floor on the south side of the building.

The official headquarters will be opened in the Claypool Hotel at noon on Tuesday, May 28, and maintained throughout the meeting.

The opening session will take place on Tuesday evening, May 28, at 9 o'clock, in the auditorium of the Claypool Hotel. An address of welcome will be delivered, with response by Frederick Remson Hutton, president of the society. The second session will be called to order on Wednesday morning, May 29, at 9:30 o'clock. This will be a business session, devoted to the reading of reports of the tellers of election of members and vote on amendments and reports of standing and special committees. The more important reports to be considered will be those of the committee on Standard Proportions for Machine Screws; preliminary report of the committee on Refrigerating Machines; Collapsing Pressures of Lap-Welded Steel Tubes (Reid T. Stewart); The Balancing of Pumping Engines (A. F. Nagle); A Comparison of Long and Short Rotary Kilns (E. C. Soper).

An automobile symposium will be held with papers on "Bearings and Moving Mechanism," by Henry Hess; "Air Cooling of Automobile Engines," by John Wilkinson; "Materials for Automobiles," by Elwood Haynes; "Special Auto Steel," by T. J. Fay; "Railway Motor Car," by B. D. Gray.

The fourth session will be held on Thursday morning, May 30, at 9 o'clock, and the subject of Superheated Steam will be discussed. Papers on "The Specific Heat of Superheated Steam" will be read by A. R. Dodge; "Determination of Entropy Lines for Superheated Steam," by A. M. Greene; "The Flow of Superheated Steam in Pipes," by E. H. Foster; "Correlation of Furnace and Superheated Conditions," by R. P. Bolton; "The Heating of Storehouses," by H. O. Lacount.

On Friday morning, May 31, a professional session will be held at 10 o'clock in one of the Purdue University buildings. The following papers will be read: "Performance of Cole Superheaters," by W. F. M. Goss; "Experience with Superheated Steam," by G. H. Barrus; "Use of Superheated Steam in Locomotives in America," by H. H. Vaughan; "Superheated Steam in an Injector," by S. L. Kneass; "A Hirn's Analysis of Locomotive Test," by S. A. Reeve. Other papers are expected.

DEFLOCCULATED GRAPHITE AND THE "ACHESON EFFECT."

BY ORRIN E. DUNLAP.

Deflocculated graphite is the latest invention of E. G. Acheson, the discoverer of the processes for making carborundum and artificial or manufactured graphite. In the deflocculated condition produced by Mr. Acheson, graphite has a condition of fineness far beyond that attainable by mechanical means. In fact, its condition resembles, if not wholly approaches, the molecular state. The "effect," for such it must be termed, is produced with water and a comparatively small quantity of gallotannic acid, and when thus treated the unctuous graphite remains suspended in the water, showing not the slightest disposition to settle. The black liquid passes with ease through the finest filter paper. Severe tests have demonstrated that it is an admirable lubricant. There is every reason to believe that deflocculated graphite with or without oil will become a popular agent for all classes of lubrication, for, strange as it may seem, deflocculated graphite possesses the remarkable power of preventing rust or corrosion of iron or steel.

It was in March, 1891, while Mr. Acheson was experimenting in Monongahela City, Pa., that he discovered carborundum. Sixteen years ago he carried about in a small vial in his vest pocket all the carborundum he had been able to produce in two months. With this vial in his pocket, he hurried off to New York city to interest diamond cutters in his new product. To them he sold the contents of that vial at seventy cents a carat, receiving $60 for all there was in the world. With this money he bought a microscope with which to study the structure of the carborundum crystals. Looking from his office window to-day, Mr. Acheson has a splendid view of the carborundum plant, and in the evening he notes that between 400 and 500 men leave it for their homes after passing the day in making carborundum and putting it in shape for sale throughout the world. It was in 1895 that commercial operations were begun in Niagara Falls, using 1,000 electrical horse-power, while to-day the works are equipped for 5,000 horse-power.

Mr. Acheson's vest pocket carries another little vial to-day, and in it is deflocculated graphite. Having given the world the hardest known abrasive, and thus advanced the art of abrasion, he has solved the problem of how to reduce the cost of lubrication.

Before the latter part of the sixties, petroleum oils were unknown, commercially, animal oils having been used for lubrication entirely. In the forty years that have passed, the world has seen a change from animal oils to mineral oils, and witnessed the growth and development of the wealthiest corporation in the world. To-day it is stated that the major part of the business of the Standard Oil Company is the manufacture not of illuminating oils, but of lubricating oils. The commerce and manufacturing of the world is guided by wheels operating in bearings, the important problem being to keep things running smoothly. No wars, no business depressions cause a cessation of the demand for lubricants.

It has been known for years that graphite is an excellent lubricating body, both in a dry state, and particularly when associated with oil, fats, or water. Strenuous efforts, extending over a long time, have been made to suspend graphite in a liquid to be used as a lubricant, but all these efforts were unsuccessful. It is a well-recognized fact among scientific men that plain water has many advantages as a lubricant if it had sufficient body to withstand the pressures brought to bear and to which lubricants are subjected. Its very high specific heat would be of great advantage to keep down the temperatures of bearings, while its low viscosity would reduce friction, but unfortunately it has not sufficient body to withstand the pressure of an ordinary bearing. It also has the fatal quality of rusting and corroding metals, thus making it absolutely worthless as a lubricant.

The "effect" which Mr. Acheson has discovered makes it possible not only to reduce graphite practically to the molecular state, and to cause it to remain suspended in water for an indefinite period of time, but also to prevent iron and steel from rusting or corroding while associated with water, thus rendering of advantage the high specific heat and low viscosity of water.

In 1901 Mr. Acheson engaged in a series of experiments having as their object the production of crucibles from artificial graphite. This led him to a study of clays, and he learned that American manufacturers of graphite crucibles import from Germany the clay used by them as a binder of the graphite entering into the crucibles; also that the German clays are more plastic and have a greater tensile strength than American clays of very similar chemical constitution, while residual clays—those found at or near the point at which the parent feldspathic rock was decomposed—are not in any sense as plastic or as strong as the same clays are when found as sedimentary clays at a distance from their place of origin. Chemical analysis failed to account for these decided differences.

Under these conditions Mr. Acheson reasoned that the greater plasticity and tensile strength were developed during the period of transportation from the place of their formation to their final bed, thinking possibly it might be due to the presence of vegetable extractives in the waters which carried them. He made several experiments on clay with vegetable extracts, tannin being one of them, and found a moderately plastic, weak clay, when treated with a dilute solution of gallotannic acid or extract of straw, was increased in plasticity. Familiar with the record of how the Egyptians made the Children of Israel use straw in the making of bricks, and believing it was used not for any benefits derivable from the weak fibers, but for the extract, he calls clay so treated Egyptianized clay.

In 1906 Mr. Acheson discovered a process of producing a fine, pure, unctuous graphite. He undertook to work out the details of its application as a lubricant. In the dry form, or mixed with grease or oil, it was easy to handle, but he wished it to enter the entire field of lubrication as occupied by oil. In his efforts to suspend it in oil, he met the same troubles encountered by his predecessors in this line of work. It would quickly settle out of the oil. His unctuous graphite was just plain, simple graphite, and obeyed the same laws covering the natural product.

This was the condition of things in the latter part of 1906, when the thought occurred to him that tannin might have the same effect on graphite as it did on clay. He tried it with satisfactory results. The writer has seen most interesting experiments made with unctuous graphite of Mr. Acheson's manufacture, a graphite which may be termed disintegrated unctuous graphite.

To one sample of this graphite plain water was added, and after rubbing it in a mortar it was poured into a test tube.

To another sample of the graphite and water and a little gallotannic acid were added also a few drops of ammonia, this last being not absolutely necessary, but having been found to improve the result with some waters. This second mixture was rubbed in the mortar as in the first case, and then was poured into a second test tube. Both tubes and their contents were thoroughly shaken, and simultaneously placed in a rack to settle.

When about two minutes had elapsed after the shaking, it was found that the graphite in the plain water had very completely separated from the water, not being miscible therewith, while the mixture of water, graphite, tannin, and ammonia remained as black as when originally shaken up. The graphite was thoroughly suspended, and showed no disposition to settle or separate.

Next from a bottle containing a quantity of graphite, water, tannin, and ammonia, which had been mixed some weeks, as stated, a quantity was poured into a glass funnel containing one of the finest filter papers made in America. The deflocculated graphite ran through the fine filter paper and collected as black as ever in the tube below, apparently unchanged. Its passage through the paper was remarkably rapid, leaving no doubt but that it was thoroughly mixed; and in order to demonstrate that the black liquid was a mixture of water and a solid body—graphite—a few drops of hydrochloric acid were introduced into the test tube containing the mixture. This was slightly warmed over a spirit flame, causing the suspended graphite to flocculate, so that when the liquid was again poured into a filter paper, the water ran through clear, the graphite remaining on the paper. A small quantity of this graphite was removed from the filter paper and rubbed on another paper, where it was dried. Then a brisk rubbing with the finger brought out the full luster of the graphite. Mr. Acheson has obtained this effect with amorphous bodies generally, alumina, lampblack, clay, graphite, and siloxicon, the only exception being magnesia, which needs further tests.

These were the conditions surrounding Mr. Acheson's experiments until the latter part of April. His success in deflocculating graphite and causing it to remain suspended in water was most gratifying, not only to himself, but to others who appreciated the wonderful possibilities of this magnificent new lubricant. However, Mr. Acheson realized that the world at large has been educated to the use of oil as a lubricant, and that it might be difficult to re-educate them to the use of water and graphite for a similar purpose until they better understood what he had accomplished. It was with this conviction that he undertook to solve the problem of replacing the water used as a conveyor of the deflocculated graphite with petroleum.

His first experiment, and probably the simplest and most rational, was to diminish the quantity of water by evaporation, leaving the graphite in a dry state, to be rubbed up later in oil. While this method produced what seemed to be an ideal result, it was soon discovered that in a comparatively short time the graphite had settled out of the oil, having lost its deflocculated condition and returned to its original flocculated state. Consequently, it was not in condition to remain suspended in oil, nor indeed was it possible again to suspend it in water, a fact strange to record.

Notwithstanding this decided failure, and the apparently insurmountable difficulty associated with the problem, the desired result was eventually accomplished. The writer has witnessed the suspension of deflocculated graphite in water, has seen the water removed, and the deflocculated graphite suspended in oil and passed through the finest filter paper, remaining suspended thereafter in a most remarkable manner. In these circumstances, Mr. Acheson now feels assured that with his disintegrated unctuous graphite, which is guaranteed to contain less than one per cent impurity, and which can be mixed with oils or grease as may be desired for all specific uses; with his deflocculated graphite in water for the lubrication of steam-engine cylinders and other places and parts where the introduction of oils is objectionable; and with his deflocculated graphite in oil, the quantity carried by the oil to be varied to suit requirements of the most difficult lubrication, he can meet any demand for a lubricant where oil is preferable and evaporation of his water lubricant might be objectionable. It should be understood in this connection that the very lightest and thinnest of oils, when used in conjunction with deflocculated graphite, can be used in the place of the heavy and expensive lubricating oils of the present day, while the lasting qualities of these graphite lubricants will be greater by far than the oil lubricants heretofore used.

Automobile Notes.

The first of the great automobile races of the year—the Targa Florio—was run off on the 20th ultimo over a mountainous and rather rough course 450 kilometers (279.45 miles) in length on the island of Sicily. The race was for touring cars with racing bodies. It was won by Nazzaro on a 35-horse-power Fiat, with Lancia on a car of the same make, second; Fabry, on an Itala, third, and Duray, on a De Dietrich, fourth. Nazzaro beat Lancia by 12 minutes, and won not only the cup but a cash prize of $3,000 as well. His time was 8 hours and 17 minutes, corresponding to an average speed of 34 miles an hour. This was an excellent performance considering the roughness of the course.

The great English race for touring cars—the Tourist Trophy race—will be held for the third time on the Isle of Man on May 28. In this race, as heretofore, each car will be allowed a certain quantity of fuel with which to cover the course, the winner being the car that covers it the quickest on this allowance. Twenty-five miles on a British gallon is the distance which is required to be covered. Nearly all the great road races held abroad this year will be based on a limited fuel consumption or cylinder capacity.

In this connection it should be mentioned that plans are being made for a similar touring car race to be held on the new motor parkway on Long Island after the Vanderbilt cup race. It is proposed to limit the cars to a certain cylinder capacity. In addition to this, it would make the race much more interesting if they were also allowed a limited supply of fuel.

The chief touring event in America this year is to be conducted by the American Automobile Association in July. This will be the third annual contest for the Glidden trophy and will start from Cleveland on July 10. The route will be through Detroit and Lansing, Mich., to Chicago; thence south and east to Indianapolis, Columbus, Cincinnati, Pittsburg, Harrisburg, Philadelphia, and New York. It is proposed to have only noon and night controls, with two minutes leeway; also to require the cars to make a good average speed behind a pacemaker and not to allow them to use any spare parts except those they carry with them. Besides the Glidden trophy for touring cars (which will this year be awarded to the club which makes the best showing) a trophy has been offered for runabouts and will be awarded to the owner who makes the best performance with this style of car.

Oxford Honors for Prof. A. G. Bell.

Prof. Alexander Graham Bell has received the honorary degree of Doctor of Science from Oxford University, in recognition of his efforts to teach the deaf and dumb to speak, as well as for his invention of the telephone. The presentation was made on May 2 last by the dean of the faculty of science, Prof. A. E. H. Love.

The first American gas engine patent, No. 3,597, issued May 25, 1844, was granted to Stuart Perry, Newport, N. Y., for his two-cycle, double-acting, air-cooled gas engine. Perry proposed to inclose the cylinder and its immediate appendages in a case, through which cold air could be blown by means of a rotary fan or other blowing apparatus. Mr. Hugh Dolnar, in an article in the American Machinist, claims that Perry not only was the original inventor of both air and water cooling of gas-engine cylinders, but also was the first to devise a hot-tube ignition system, which was reinvented and patented many years later by Gottlieb Daimler.

AN AUTOMOBILE HEARSE.

A lugubrious automobile novelty in the form of a motor-driven hearse has recently made its appearance in the streets of Paris. A nation that rejoices in the grim delights of trolley-car funerals is hardly justified in shaking its head at this latest application of the electric auto. After all is said and done, no very good reason can be advanced why a man should not be buried in a ceremonious and somber motor hearse, particularly in these piping motor times, when touring cars filled with tearful mourners are not infrequently seen in funeral processions.

AN ELECTRIC AUTOMOBILE HEARSE NOW IN USE IN PARIS.

THE BLERIOT AEROPLANE.

BY THE PARIS CORRESPONDENT OF THE SCIENTIFIC AMERICAN.

M. Bleriot, a well-known Paris engineer, has lately re-entered the aeronautical field with an aeroplane of a new design. In its general lines it closely resembles a bird, with a central body, long tail and two large outspread wings, and it differs in many respects from the other flyers which have been brought out at Paris. Here there is but a single plane formed of the two flat wing surfaces. The skeleton frame of the apparatus is entirely covered in the present design, this frame being rigid as well as elastic. The general lines of the flyer are designed so as to give it as small a resistance in the air as possible, and to this end the covering is formed of a kind of parchment paper which is very efficient in reducing the air friction, owing to its polished surface. Some of the other arrangements of the flyer are quite ingenious. As will be noticed in the accompanying views, the body of the bird consists of a central portion which contains the motor and the aeronaut's seat in the front part, followed by a tail-like appendix which, like the rest, consists of a covered skeleton frame. The tail has the form of a quadrangular pyramid, tapering to a rather sharp point. At the rear end of the tail M. Bleriot has mounted the two rudders which control the flight, with the horizontal rudder consisting of a canvas-covered frame placed at the extreme end, while next it is the vertical rudder. Both the rudders are operated from the aeronaut's seat by means of universally-jointed rods connected to a single lever for both rudders. By working this lever, the rudders can be used together or separately as the pilot desires. Means are provided for changing the angle of the wings, and this is carried out by a lever which the pilot has placed between his knees. Thus either one of the wings can be raised or lowered at the desired angle, within certain limits. This will no doubt be a considerable aid in handling the flyer. One of the views shows the two wings folded up when the aeroplane is not in use, thus making it possible to occupy relatively small space when stored away. The form of the wings is also noticeable. They are somewhat enlarged at the ends and are curved upward at the tip. At the base, the width of the wing is 2 meters (6 feet 7 inches), and the total spread of the wings is 7.50 meters (24 feet 8 inches). The surface of the aeroplane is 13 square meters (139.8 square feet) and the weight is 260 kgs. (573 lbs.). As to the motor, it is located in the front end of the middle frame, and is of the 24 horse-power Antoinette pattern, which we have already had occasion to describe. The propeller is mounted in front on a short shaft, direct connected to the crank shaft. It is 1.6 meters (5¼ feet) in diameter. Two bicycle wheels are used to support the flyer on the ground. They are mounted on a common axle which is fixed to the middle part of the body.

The new flyer was recently put through its first experimental trials at the Bagatelle grounds in the suburbs of Paris, and these trials were quite remarkable in several respects. In the trial of April 5th the aeroplane was set in motion against a somewhat stiff breeze, with M. Bleriot piloting. After running for a few hundred feet on the ground, it rose to a height of two feet above the ground and was able to fly for a short distance, about twenty feet. But the aeronaut feared that it would be driven to one side by the wind, and so was obliged to bring it to the ground. What is brought out in this short flight is the general good performance of the apparatus and the small amount of power which is needed for flying, seeing that it has a motor of only twenty-four horse-power. In another experiment it was found that the aeroplane could be made to leave the ground with its small carrying surface of 140 square feet, without even using the whole power of the motor, the actual amount being estimated at sixteen horse-power.

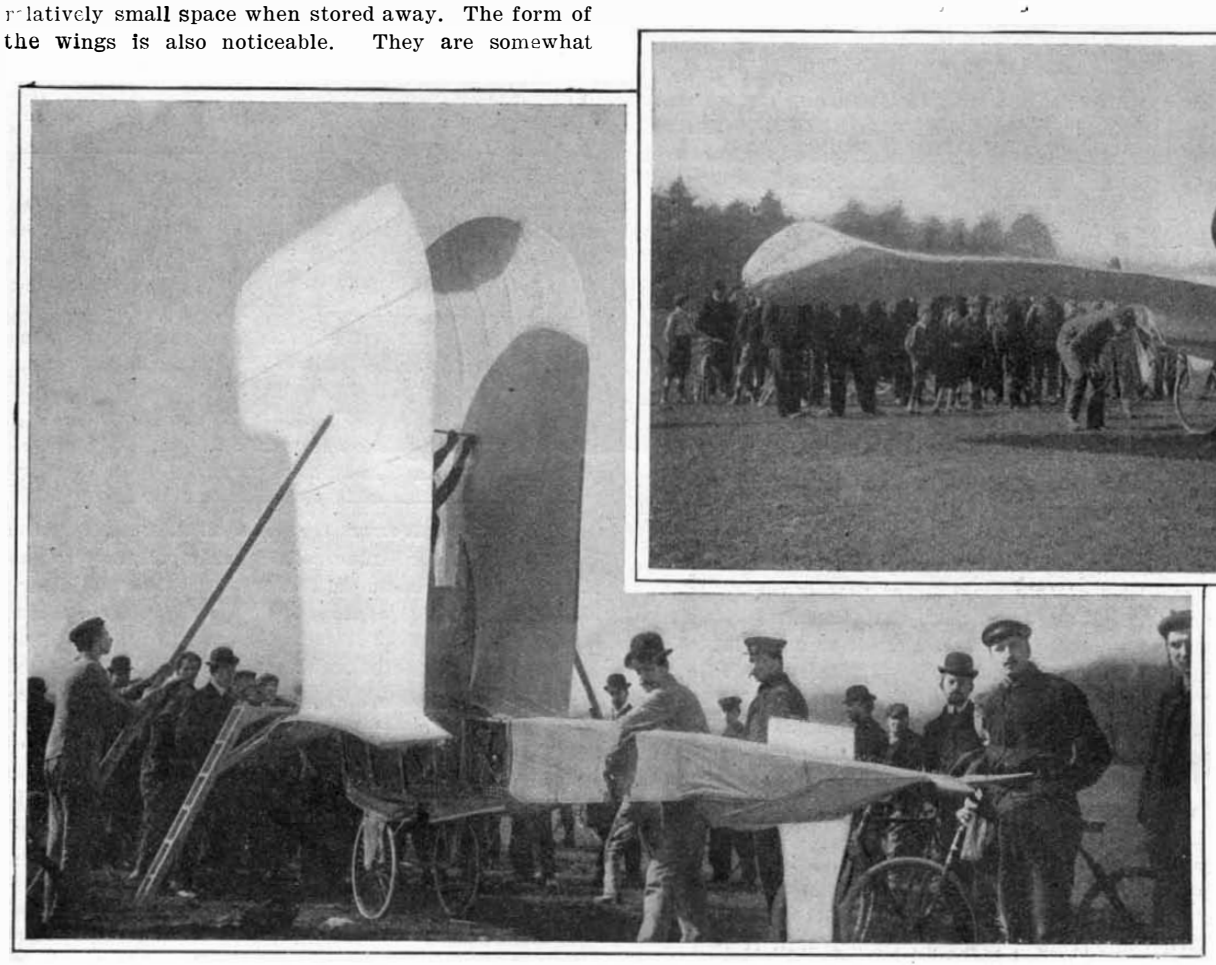
After the trial on April 5, during which the axle connecting the wheels was bent upon landing, M. Bleriot strengthened his machine somewhat and added a third small wheel at the end of the tail in case the latter should drag when the machine is leaving the ground. He also increased the size of the forward horizontal rudder and doubled the surface of the vertical rudder at the rear. In another trial on April 8 the machine rose off the ground slightly when the horizontal rudder was directed upward, but a gust of wind upset it.

Failure of Santos Dumont's Aeroplane.

After previously demolishing his new aeroplane in the first trial he made with it, Santos-Dumont, during the first week in April, refitted his 50-horse-power 8-cylinder motor to his old machine—"14bis"—with which he won the Archdeacon cup for a flight of 220 meters last November. After waiting several days for good weather, he at length attempted to make a flight in a light wind of but 5 or 6 miles an hour velocity. He succeeded in getting the machine up in the air after a run of about 100 feet along the ground, but it showed great lack of stability and lurched from side to side. After flying less than 200 feet, the machine made a sharp turn and the left wing touched the ground. Santos-Dumont attempted to counteract the sudden turning of the machine by a quick movement of the rudder, with the result that the rudder struck the ground and the machine collapsed. Its intrepid pilot escaped unharmed by ducking down in the basket. This trial has demonstrated anew the instability of a machine of this type.

The Delagrange aeroplane, on the other hand, in a trial on April 8, although it showed very good stability while in the air, was damaged when it struck *terra firma*. In this case, too, the slight wind that was blowing was said to have driven the machine forcibly to earth when the motor was stopped. The wheels and some of the tubes of the framework were broken. The flight was only 50 meters (164 feet) in length at a height of from 15 to 20 feet. A previous flight, on March 30, was 60 meters (196 feet) in length. In both instances the pilot, M. Voisin, cut off the ignition current and stopped the motor, fearing injury to the spectators.

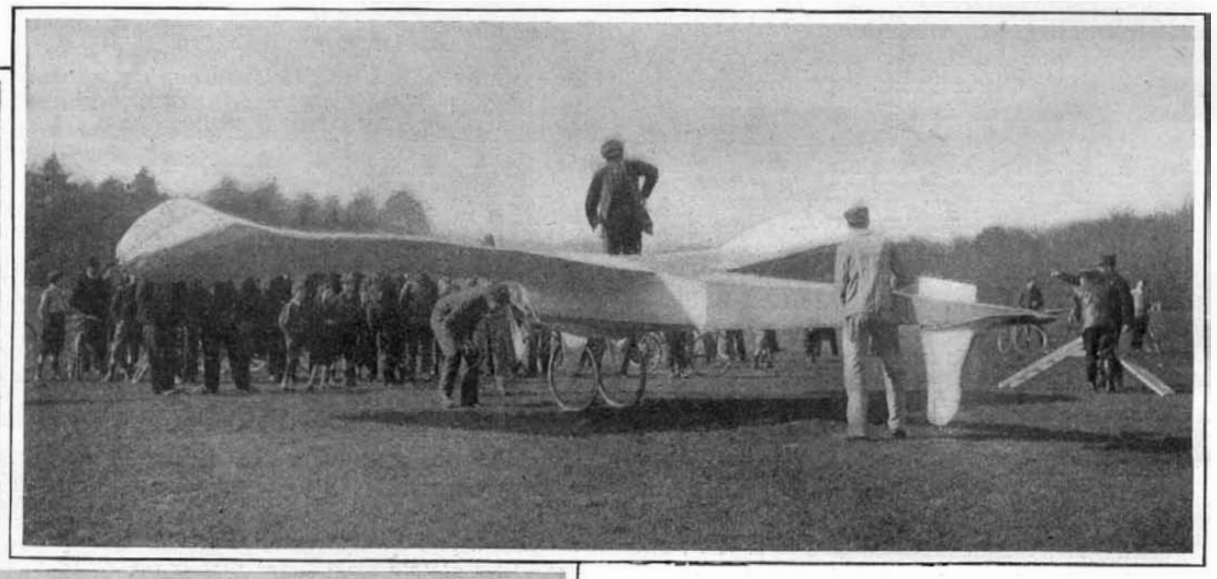
While these experiments show that there are several machines in France capable of getting off the ground, and that this capability is confined to no one type, still they prove that the conquest of the air is not yet so near completion as some would suppose, and that there is much yet to be done before a successful flying machine will be evolved.



Attaching the Wings to the Aeroplane Upon Its Arrival at the Testing Place.

The wings of this aeroplane are formed of parchment paper applied to a suitable framework.

THE BLERIOT AEROPLANE.



The Bleriot Aeroplane With Its Wings Outspread.

Razor Strops.

These are prepared from strips of linoleum of the usual length and width, left for 24 hours in a ⅛ to ¼ per cent. solution of hartshorn salt, to which 1½ per cent. of alum has previously been added, at the ordinary temperature; the strips are then dried at the normal temperature, rubbed with soap and polished with pumice stone. They are finally fastened in the usual manner to wooden handles. Strops made in this way will give a smooth sharp edge to the razor.

THE TALKING SIREN OF DR. MARAGE.

BY DR. ALFRED GRADENWITZ.

While many early inventors attempted to produce an apparatus which synthesized the elemental sounds used in talking and which imitated the human voice, the invention of the phonograph gave such experiments their quietus.

Despite the success of the phonograph, a French scientist, Dr. Marage, has constructed what may be described as a talking siren, that is, a siren which produces sounds that accurately imitate those of the various vowels both when sung and spoken.

In constructing this device, Dr. Marage intended primarily to design an apparatus for gaging the sharpness of the sense of hearing in different individuals. The "acoumeters" previously constructed for the purpose may be divided into three classes, producing respectively noises, musical vibrations, or the vibrations of spoken words. The first two classes will obviously give only a faint idea of the way in which a given individual may be able to perceive spoken words. In fact, many persons have a rather limited capacity of hearing ordinary speech but are able to hear distinctly either musical vibrations or noises. The reason is to be found in the more complex character of spoken words.

A graphical record of vowels (such as the flames of König) is composed of a certain group of vibrations. French "i" (English "e") and French "ou" (English "oo") are composed, for example, of isolated vibrations, "é" (English "ay") and "o" by groups of two, and French "a" ("ä" as in "father") by groups of three vibrations. In order to reconstitute these vowels, the groups referred to should thus be artificially reproduced. To this effect slots arranged in groups of one, two, and three respectively are cut in a rotatable circular disk. When air is blown through these slots the vowels mentioned will be distinctly heard. In fact, they are not only recognized by the ear but give the same graphical records as natural vowels or the vowels produced by a phonograph. However, they correspond with sung vowels only. In order to obtain spoken vowels the air current is made to pass through special molds (Figs. 1, 2, 3, 4), which accurately imitate the form of the human mouth in pronouncing a given vowel. The graphical records of these sounds are absolutely identical with those of natural spoken vowels. An artificial talker is thus obtained and the apparatus in question may be fitly termed "vowel siren" or "talking siren."

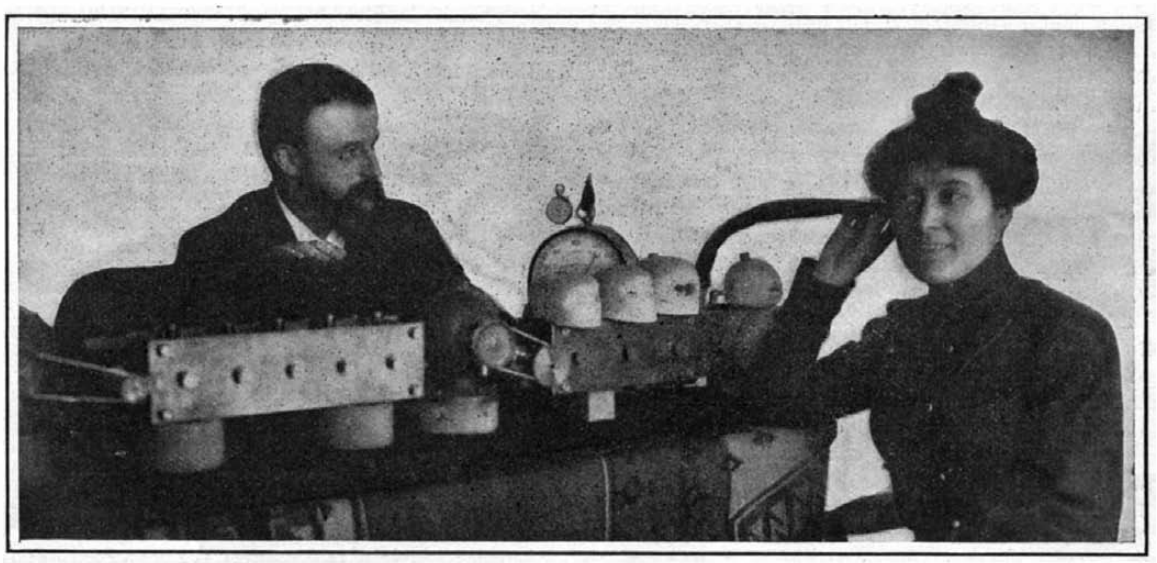


Fig. 5.—An Apparatus for Teaching the Deaf How to Hear and for Massaging the Ear.

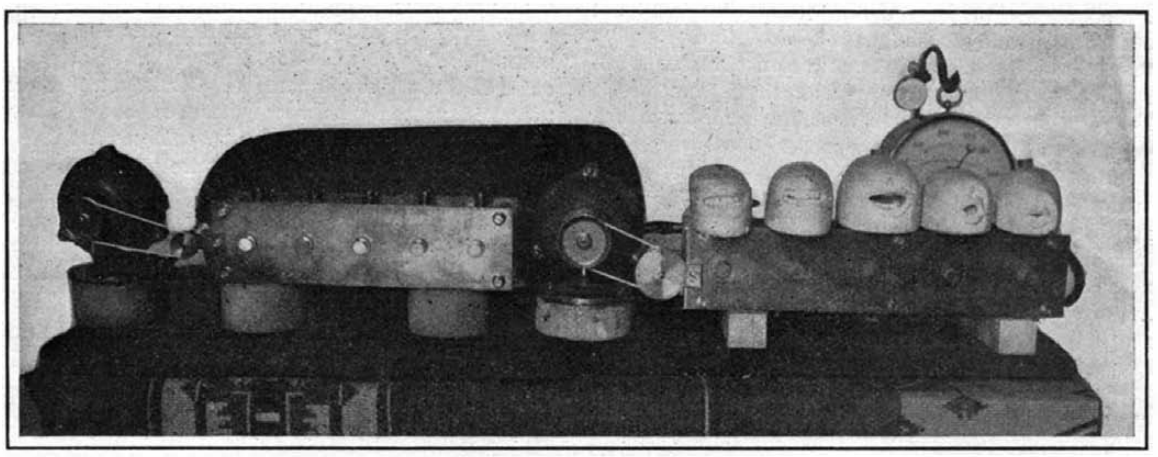


Fig. 6.—Two Sirens, One with a Complete Set of Mouthpieces.

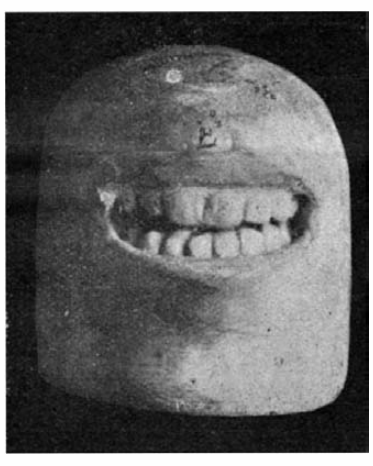


Fig. 1.—Artificial Mouth for Producing the Sound of French "é." (English "a" as in "Make.")

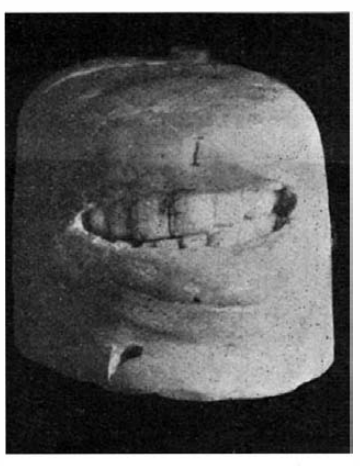


Fig. 2.—Artificial Mouth for Producing the Sound of French "i." (English "e.")

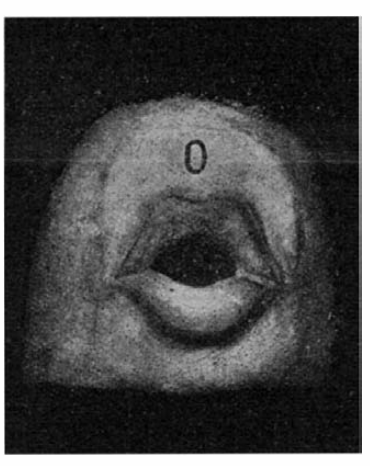


Fig. 3.—Artificial Mouth for Producing the Vowel Sound "o."

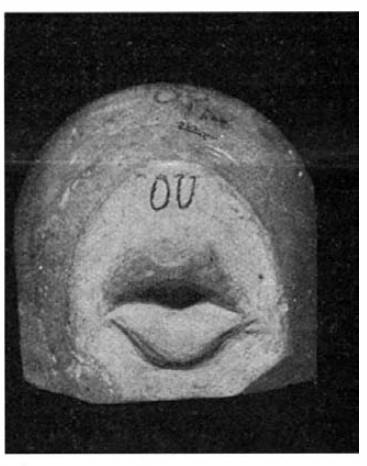


Fig. 4.—Artificial Mouth for Producing the Sound French "ou." (English "oo," as in "Moon.")

The most valuable property of this apparatus is that the intensity of the sounds given out by it is accurately proportional to the pressure of the air current. It thus affords a means of gaging the intensity of a given sound and producing a sound of any desired strength. This is made use of in determining keenness of hearing.

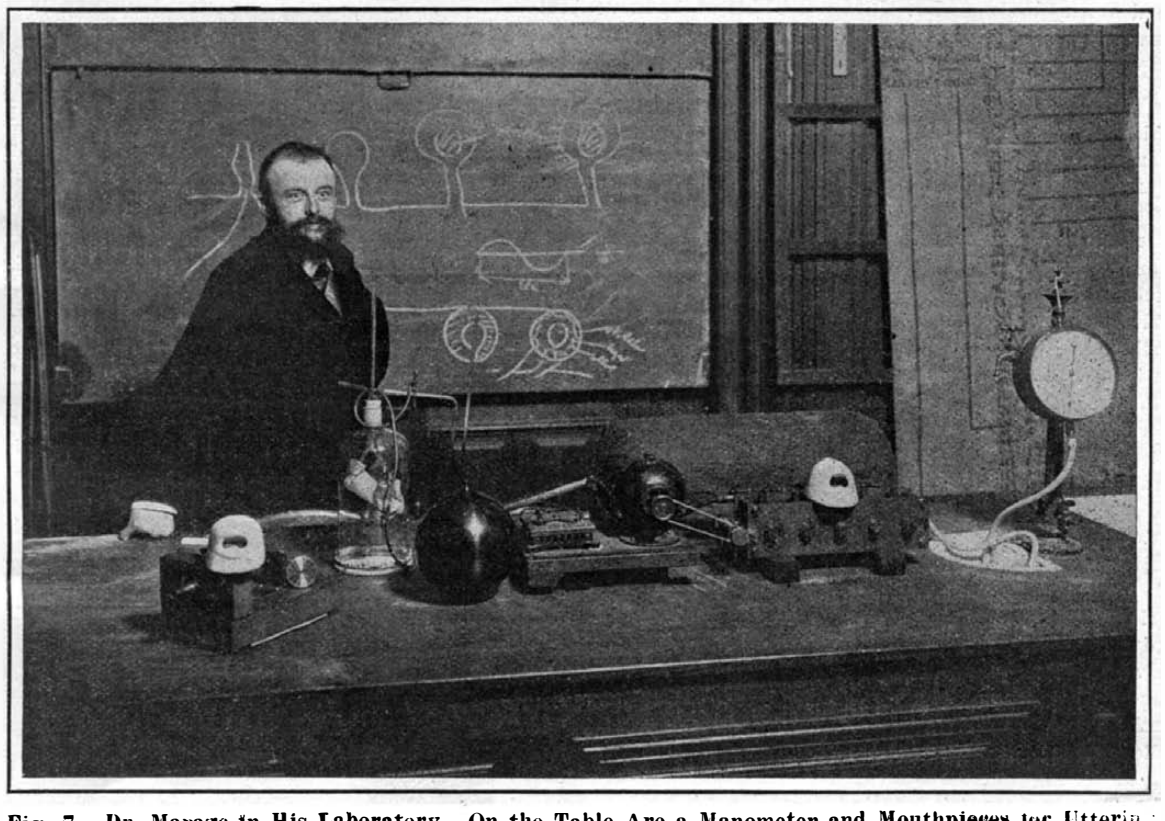


Fig. 7.—Dr. Marage in His Laboratory. On the Table Are a Manometer and Mouthpieces for Uttering Vowel Sounds.

THE TALKING SIREN OF DR. MARAGE.

The ear to be tested should be placed at a constant distance from the instrument, the sound intensity of which is gradually increased by augmenting the pressure of the air, this pressure being gaged by means of a highly sensitive metallic manometer.

The sound produced by a pressure of 1 millimeter is perfectly well perceived by a normal ear. If the pressure for an ear must be raised to 40 millimeters before the sound can be heard, the acoustic sense of the patient may be said to be 1/40, if to sixty, 1/60, if to two hundred, 1/200, and so on—a simple and efficient scale. The apparatus thus affords an extremely simple measuring instrument, which always remains constant. Its readings may be accurately checked and reproduced whenever desired.

The condition of a given ear is gaged and represented by the following graphical method:

The French vowels "ou," "o," "a," "é," "i" (or their English equivalents) are inscribed on a horizontal line, and below each of them, as shown in the accompanying table, a vertical scale is drawn with graduations corresponding with the pressure read on the manometer at the moment the vowel in question is perceived. If for instance the French vowels "ou," "o," "a," are perceived under a pressure of 8 millimeters, the point 8 on the scales corresponding with each of these vowels is marked; if "é" is heard under a pressure of 21 millimeters, the point 21 is marked on the "é" scale. Finally the point 162 is marked on the scale of the French vowel "i," if the latter is heard under a pressure of 162 millimeters; these five points are then connected by a line and a curve will

be obtained. From these curves, varying markedly in shape, the following conclusions can be drawn:

1. If the ticking of a watch, which is normally heard at a distance of 1.5 meters, is heard only when applied to the ear, the acoustic intensity, according to the talking siren, will have become 1/3.

2. If auditive acuteness further decreases, being finally comprised between 1/3 and 1/13, the patient, although he may be able to hear a particular conversation, will lose many words in a general conversation.

3. In the case of an auditive acuteness of less than 1/13, the patient will unconsciously train himself to listen only with the other ear, if this be normal. The deaf ear will perceive only those sounds which are pronounced very distinctly at a short distance.

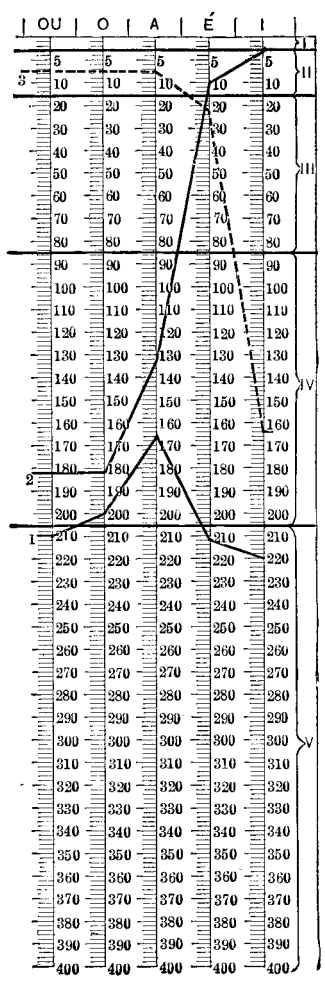
4. Between 1/30 and 1/200 only those words which are spoken in a very loud tone close to the patient will be heard.

5. Beginning from 1/200, spoken words will be heard only by means of a hearing tube.

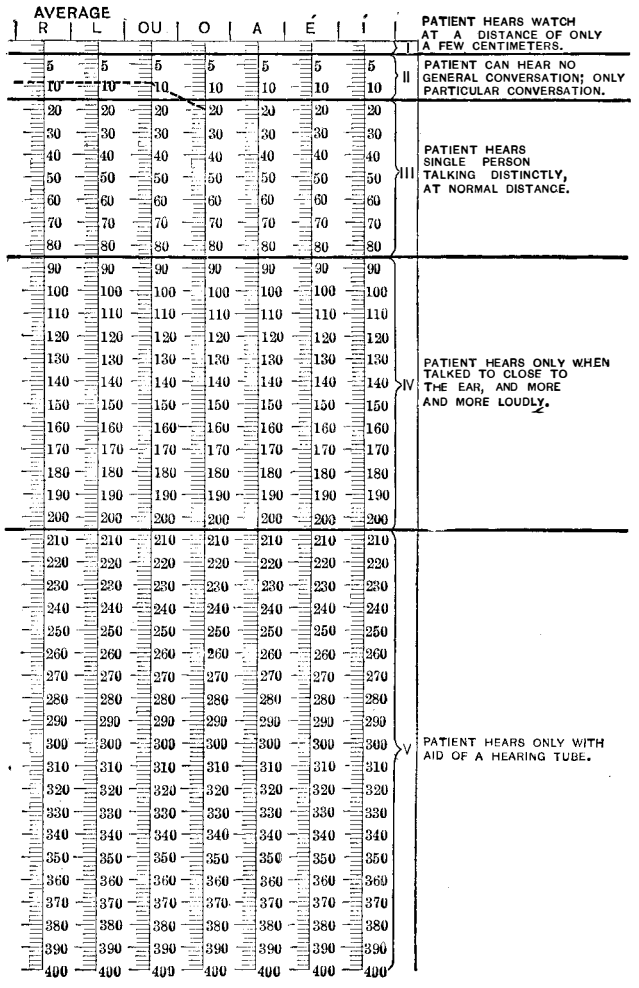
These five zones of deafness are separated in the table by heavy horizontal lines. As long as the hearing remains within a given zone, the patient will not feel any appreciable change and only those talking with the patient may appreciate some variation in the loudness of their words. The siren thus allows the perception of degrees in acoustic intensity which the patient himself or direct observation could not ascertain. After measuring the acoustic intensity and drawing the curve of a patient, the shape of the curve will locate the seat of the trouble. If for instance the curve has the approximate shape of an inverted U, only the middle ear will be affected. Thus each peculiar affliction will have its special characteristic curve.

While the siren can thus be used for diagnostical purposes it will be found useful also in curing the trouble. In fact, a systematic treatment consisting in the repeated production of given sounds before the tympanum of the ear has been found to be a most efficient "massage," which in some cases restores the ear to normal hearing capacity, while nearly always effecting some improvement (Fig. 5). This process has also been used with much success in the treatment of deaf-mutes, many of whom have been taught to hear by its means. In this case the ear is taught according to a method which from the most simple elements of speech, that is the vowels, proceeds to the more complicated, the deaf-mute learning how to hear in exactly the same way as a child is taught how to read by beginning with the alphabet.

In a memoir recently presented to the French Academy of Sciences, Dr. Marage records some interesting experiments made by himself as to the acoustic qualities of some large halls of the city of Paris. He confirms the result found some years ago by Mr. Wallace Sabine, viz., that the sound of resonance is the principal factor in question. The duration of this sound, as stated by Marage, will vary according to the intensity, pitch, and timbre of the primitive sound, which possibly accounts for the fact that a given hall may be bad for an orchestra and satisfactory for an orator.



Analytic Curve Obtained With Dr. Marage's Apparatus.


AVERAGE
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PATIENT HEARS WATCH AT A DISTANCE OF ONLY A FEW CENTIMETERS.
PATIENT CAN HEAR NO GENERAL CONVERSATION; ONLY PARTICULAR CONVERSATION.
PATIENT HEARS SINGLE PERSON TALKING DISTINCTLY, AT NORMAL DISTANCE.
PATIENT HEARS ONLY WHEN TALKED TO CLOSE TO THE EAR, AND MORE AND MORE LOUDLY.
PATIENT HEARS ONLY WITH AID OF A HEARING TUBE.

Dr. Marage's Table of Auditive Acuteness.

THE TALKING SIREN OF DR. MARAGE.

Alcohol Engines to Replace Gasoline Engines.

BY JOHN PRESTON.

Although the general use of gasoline engines has developed entirely within the past ten or twenty years, the number of such engines in this country is now high up in the hundreds of thousands, being used as they are for automobiles and as stationary engines for pumping water, running small factories, and for furnishing power for various uses in country residences and on farms.

The law which recently took effect, releasing from the internal revenue tax alcohol so denatured as to render it unfit for drinking, permits, through decrease in price, alcohol to become a possible substitute for gasoline and kerosene as a fuel.

The price at which a gallon of 95 per cent grain alcohol can be manufactured and marketed is now about 40 cents. The government tax raised the market price to about $2.50 per gallon; it is now 37 cents per gallon for the denatured alcohol. In order to avoid paying the revenue tax, the government regulations prescribe that the alcohol must be denatured according to the following rule: To 100 parts of grain alcohol of not less than 90 per cent strength must be added 10 parts of wood alcohol and one-half of one part of benzine. Consequently, the mixture will not only be very poisonous, but will have a strong, disagreeable odor, which will obviate any danger of its being confused with pure alcohol.

Alcohol is an inflammable liquid, and its vapor, when combined with the right proportion of air, forms an explosive mixture suitable for use in engines. Alcohol differs materially in its properties from gasoline. It is less volatile, it gives out less heat per gallon when burned, and its latent heat of vaporization is much greater than that of gasoline.

Although for ten years alcohol has been used to a considerable extent in special alcohol engines on the continent of Europe, such use has been untried in this country.

In Europe alcohol engines have differed from gasoline engines chiefly in the use of a higher compression than is permissible when gasoline is used as a fuel, and in the use of a more or less intricate form of heated carbureter.

Since no alcohol engines are on the American market, all the tests by the United States Department of Agriculture have been made on American engines designed for gasoline or kerosene as fuel.

Every engine tried—ten different kinds in all—was found to work as perfectly on alcohol fuel as on the gasoline or kerosene fuel for which it was made, after sufficient preliminary trial to determine the peculiarities of setting and adjustment necessary for the alcohol. The engines tried included stationary engines up to 20 horse-power, automobile engines up to 40 horse-power, and one marine engine. The engines were of nearly every type—one to four cylinder, horizontal and vertical, four cycle and two-cycle, gasoline and kerosene. Since alcohol is much less volatile than gasoline, it was to be expected that difficulties would arise in its use in a gasoline engine. These difficulties were often very curious, and in some cases seemed for a time quite baffling, but they all yielded to patient study. The proper vaporization of alcohol before its introduction into the engine cylinder is a question which requires for its solution a comprehensive knowledge of the vapor pressure and of the other properties of alcohol as compared with gasoline.

With all the engines it was found that the valve adjustments must be quite different for alcohol from those used for gasoline. Gasoline is so volatile, that it might be almost said to vaporize itself. On the contrary, the vaporization of the alcohol must be carefully attended to. When gasoline is used as a fuel, it is sometimes difficult to start an engine out of doors in the coldest weather. Under like conditions it would be impossible to start an engine using alcohol without the aid of a little gasoline or without first heating the engine in some manner.

There are several important differences between the behavior of an engine when running on gasoline and its action with alcohol. With alcohol fuel there is never any hammering due to pre-ignition. The explosions are slower and consequently less noisy, and there seems to be correspondingly less wear and tear on the machine. The exhaust is never strongly disagreeable in odor, as may be the case with gasoline. With alcohol fuel an engine may be overloaded to an amount considerably in excess of its maximum possible power on gasoline. In other words, an engine rated at 10 horse-power on gasoline might be called a 12 horse-power engine when running on alcohol.

A gasoline engine requires about twice as much alcohol measured in gallons as it does gasoline to develop the same power. This excess in consumption of alcohol would doubtless be reduced in engines specially designed for alcohol.

This increased consumption of alcohol is to some extent offset by its much greater cleanliness when handled and used, the absence of disagreeable noise and odor, and the very great diminution of danger from fire.

On account of the low degree of volatility of alcohol, it is possible to run into the engine an amount greatly in excess of its requirements. This excess will pass through the engine without doing any good. Hence to secure the most economical use of this fuel, perhaps greater care in the valve setting of the engine is required than is the case when gasoline is used.

It has been completely proved that alcohol is perfectly adapted for use as an engine fuel; and, except for its present cost, the advantages of alcohol as a fuel far outweigh those of gasoline. As the use of alcohol engines increases, large quantities of alcohol will be made, and the denatured product will be as easily obtainable anywhere as is kerosene at the present time. The price will doubtless become materially lower than it now is.

If, under the stimulus of demand, inventors and manufacturers will combine to devise, and put on the market, special alcohol engines fitted to secure the highest economy in the consumption of the fuel, we may expect to see, within a few years, alcohol engines as numerous as gasoline engines are to-day.

Official Meteorological Summary, New York, N. Y. April, 1907.

Atmospheric pressure: Highest, 30.38; lowest, 29.16; mean, 29.89. Temperature: Highest, 73; date, 25th; lowest, 26; date, 2nd; mean of warmest day, 61; date, 26th; coolest day, 35; date, 1st; mean of maximum for the month, 52.2; mean of minimum, 37.7; absolute mean, 45; normal, 48.6; deficiency compared with mean of 37 years, —3.6. Warmest mean temperature of April, 54, in 1871. Coldest mean, 41, in 1874. Absolute maximum and minimum of this month for 37 years, 90 and 20. Average daily deficiency since January 1, —1.1. Precipitation, 3.89; greatest in 24 hours, 0.97; date, 9th; average of this month for 37 years, 3.37. Excess, +0.52. Accumulated deficiency since January 1, —1.48. Greatest precipitation, 7.02, in 1874; least, 1.00, in 1881. Snowfall, 6.1. Wind: Prevailing direction, N.W.; total movement, 9,924 miles; average hourly velocity, 13.8; maximum velocity, 52 miles per hour. Weather: Clear days, 8; cloudy, 8; partly cloudy, 14. Fog, 29th, 30th. Thunderstorms, 23rd, 26th. Remarks: Coldest April in 32 years.

The best efficiencies of centrifugal pumps are supposed to have been obtained at discharge velocities equaling about 12 feet per second through the discharge aperture of the pump. Recent experiments have shown that from pumps as large as 32 inches 80 per cent efficiency was obtained at 38.68 feet lift, under a discharge velocity of 21.2 feet per second, while some recent tests on very small pumps show gradually increasing efficiencies under heads up to 89 feet and discharge velocities of 40 feet per second.

The pipe line, conveying petroleum from Baku to the Black Sea, has been completed. It is 550 miles long, and is capable of passing 400,000,000 gallons of oil yearly. Another important oil pipe line has been built for transporting Texas and California petroleum across the Isthmus of Panama. It is 8 inches in diameter and 51 miles long.

Correspondence.

Broken Rails.

To the Editor of the SCIENTIFIC AMERICAN:

In your issue of the 20th ultimo you brought out an article on "Broken Rails." Since then the New York press has taken this matter up, as well, and it has thereby received some publicity. I have not noticed any further article in your paper, and would therefore suggest that you give your readers all the information on this score which it is possible for you to do. There is nothing that will cure so stupendous a fraud as this, perpetrated on the public, who are really the owners of the railways, and therefore the purchasers of rails, as the truthful and persistent exposure of the methods by which this fraud is enacted. Among an intelligent public, you have an excellent opportunity for exposing these facts. RUDOLPH R. HOFFMANN.

Brooklyn, N. Y., May 1, 1907.

Railroad Accidents.

To the Editor of the SCIENTIFIC AMERICAN:

The illustrated article on page 232 of the March 16 issue of the SCIENTIFIC AMERICAN, in regard to railroad accidents occasioned through neglect, carelessness, forgetfulness, or whatever may have been the fault, is remindful of quite too many similar accidents—similar in the fact of the same cause—within the recollection of all who have had much to do with the operation of railroad trains.

The article, aside from the meritorious criticism of the common practice of placing lightly constructed equipment between two that are much stronger and heavier, and the deplorable necessity that exists for maintaining "facing switches," further illustrates the lack in advancement and the weakness in conditions that will permit frequent repetitions year after year, and continue placing extremely hazardous responsibility and dependence on the fallibility of the human mind.

Quoting from the article: "It is certain, however, that greater precautions could be taken to safeguard such switches." It is remarkable that, with the many improvements in rolling stock and appliances tending to betterment of the commercial interests of railroads, there has been so little advancement in the facilities and appliances that constantly and fearfully menace public safety in travel. True, the automatic block signal system is a great advance over the primitive methods of "by rule and by guess," yet it is the one pronounced improvement toward safety in travel, that is not more a change of "rules" than appliances. The improvement in construction is splendid, so far as it goes, but when improved construction is placed next to the inferior, the benefit is mostly lost in the test, while the danger is greatly intensified.

The only improvement in switches that has been effected in the past forty or fifty years, was the substitution of the "stub" by the "split" switch; and practically no change whatever in the switch stand, except as to pattern and the revolving staff instead of the "throw lever"—simply change as to ease of operation, not adding a particle to the safety of passing trains. The signals are the same, as to effectiveness, and just as impossible of discernment—even more so, with the greatly increased speed and fewer stops.

With the many, constantly increasing duties required of the engineer, and the frightful speed exacted of him, the unceasing wonder is that he distinguishes the multitude of signals he encounters. The fact is, that he proceeds on faith that every man is faithful in his duty, as it is impossible that he can see every insignificant switch target at sufficient distance to enable him making the stop if it is set wrong. The contention is well taken: "Not only should the switch signals be mounted on a lofty post, but a lofty distant signal should be provided." Better than the last, would be a distant alarm signal that would operate a loud-sounding gong in the locomotive, through wheel contact.

While "facing" switches are necessary with single, and not with double tracking, the liability of "wrong switch" is still to be considered. Local and slow trains are required to clear the faster, in passing. The difference would be, in a forgotten switch, that the collision would be rear instead of head on. The fatality could be as great, or greater.

The remedy is not in more stringent rules, nor altogether in certain signaling, but in more assured switch closing. How is that to be done? Certainly through automatic mechanical action. Allow me to suggest that the proper and normal position for a switch should be *closed*, and under no circumstance should it be possible to *leave* it in an open position. Were this adopted, it would not be necessary to protect against open switches, as there would be none. It would be necessary, however, to make it a penal offense to, at any time or for any purpose, use means of fastening open; and it would be necessary that the person operating the switch should hold it open during the passage of wheels through.

This may be accomplished by a gravity mechanism, that, as soon as released from the hand, would fall to the normal or closed position. This operation of opening during necessity could be made secure, just while being held open, by means of a secondary gravity clip that would effectually lock the switch open only so long as the switchman retained it in his hold.

A remiss duty would seldom cause more than simple derailment of a few trucks or cars, under the customary use of switches. E. S. CRULL.

Sedalia, Mo.

A THEATER AUDITORIUM TURNED INTO A BALLROOM AT A MOMENT'S NOTICE.

The problem of a ballroom sufficiently large to house a considerable number of dancers, or to provide space for banquet tables, has been solved in a more or less satisfactory manner by boarding over the orchestra and parterre of the theater or opera house. Such makeshift is necessarily clumsy and unsatisfactory. Horses, framing, and boarding must be stored at all times, affording excellent food for fire. Much time and expense is entailed in erecting the flimsy temporary structure each time it is used. A French inventor, Dr. Eugène Gravelotte, conceived the rather brilliant idea of applying the principle of the waffle iron to the floors of theaters, and a new Paris music hall in the Rue de Clichy has been provided with this somersaulting orchestra floor, which can be changed in seven minutes from the usual conventional inclined floor with comfortable chairs to a horizontal, highly-polished dance floor. The carcass which holds the twin floors in a parallel position revolves about a horizontal axis in a pit permitting of a complete revolution.

Our front-page engraving gives some idea of this audacious transformation. The dimensions of the revoluble sections of the floor are as follows: Length, 53 feet; width, 50 feet; and the depth of the pit is 30 feet. Metallic trunnions or pivots are secured to the carcass. On one of the two twin floors are nineteen rows of orchestra chairs. There is a difference in level of some 7 feet when the dance floor is in use. Steps lead down from the foyer. The mechanism for making the transformation is very simple. Up over the proscenium are motors which actuate drums around which are roved steel cables, which are in turn roved around the trunnions. The principle is the same as winding a string upon a lead pencil. When the string is pulled the pencil revolves. The total weight of the construction is 90 tons, yet so well is the floor balanced that a 2-horse-power motor is all that is required, and the cost of operation is only eight cents for each transformation. The installation cost the moderate sum of $14,000, of which $9,000 was used for building the carcass, the floors, and the operating mechanism, and the balance was taken up in excavating the pit and in the masonry. The greatest difficulty connected with the installation was to find an engineer with enough courage to make the necessary calculations for the realization of the idea.

The Current Supplement.

For the fourth time there were held at Monaco, from the 2d to the 14th of last month, the Motor Boat Show and Races that have come to be the great annual spring event in Europe. The races this year were noted for the record of the Panhard boat, which kept up a speed of 30 knots for three hours, the best performance ever made by any motor boat. In the current SUPPLEMENT, No. 1636, the Paris correspondent of the SCIENTIFIC AMERICAN thoroughly describes these races and gives details of the feats of the individual boats. Illustrations of the more prominent types accompany the text. Of technological interest are articles on the "Slaking of Plaster and Means of Retarding Its Hardening," "Waste Products from the Manufacture of Glue," "Process of Producing Plaster Free from Bubbles," "The Manufacture, Denaturing, and the Technical and Chemical Utilization of Alcohol" (the first of two splendid installments on this subject by M. Klar, a well-known German alcohol chemist), and "The Powell Process of Preserving Wood with Saccharine." A new telephone dictating apparatus, invented by Turner and Germer, is described. "What is a Watt?" is the title of an article by George S. Hodgins, which explains clearly the meaning of this electrical term. Among flying-machine experimenters there is about as great a diversity of opinion on air-propeller shapes as there is a dearth of actual knowledge of their efficiencies. For that reason Mr. A. M. Herring's article on an air-propeller testing device should be particularly welcome, inasmuch as Mr. Herring is himself a well-known aeronautical expert. "A Quarter Century's Progress in the Applications of Electricity," is the title of a splendid review of modern electrical achievements. Dr. Alfred Gradenwitz writes on a German system of compressed-air cleaning. The intensity of the tropical sun and its effect on the human body is discussed by Surgeon-General Stendel. Joel A. Allen writes on the influence of physical conditions in the genesis of species.

The Wellman Expedition to the North Pole.

BY THE PARIS CORRESPONDENT OF THE SCIENTIFIC AMERICAN.

Mr. Walter Wellman has already made his plans for the expedition to the North Pole which he expects to make during the coming season. He states that the steamer which is to take the expedition to its starting point in the Danish islands has already arrived at Trondhjem, Norway, where it is now lying in dry dock, and it will be ready to leave for Spitzbergen about the first of June. The party which is to proceed to the islands is made up of some thirty-five persons. The sleds are to be drawn by dogs coming from the north of Siberia from the Samoiedes tribes dwelling on the banks of the Obi River. As to the airship, of which we already gave an illustrated account some time since, it has been entirely rebuilt in the Mallet aeronautic establishment at Paris. According to the present design, it measures 55.8 meters (183.7 feet) in length, with a middle diameter of 16 meters (52.8 feet). The volume of the balloon is 7,500 cubic meters (9,825 cubic yards), and it will have an ascensional force of 8,870 kilogrammes (19,515 pounds). Near Paris is being constructed a new nacelle which is built entirely of steel, with a motor and improved mechanical parts for the helice, these having been designed by Mr. Wellman. The mechanical design has some original features which differ to a great extent from what has been hitherto constructed for airships. Built of steel tubes which give it lightness as well as stiffness, the nacelle has a total length of 115 feet. Together with the steel part is built a large reservoir which is expected to contain all the gasoline needed for the trip to the pole and return, this being 6,800 liters. As regards the principal motor mounted on the nacelle, it is rated at 60 to 70 horse-power. Directly mounted upon the motor shafting are two helices of steel having 11.5 feet diameter, and there is one such helice at either end of the nacelle, resembling in this respect the design which is adopted by the Lebaudy brothers in the airship "Patrie." A good speed is expected to be made by the new airship, this being calculated at fifteen to eighteen miles an hour, and there will be enough fuel in the reservoir to give a continuous flight of 150 hours at full speed. This is expected to allow the airship to cover a radius of 2,000 miles, and is nearly double the distance from Spitzbergen to the pole and return, so that there is a good margin allowed. All the mechanical parts have been put through a good series of practical tests for some time past. When the airship is entirely set up at Spitzbergen during the month of July next, a series of trial tests will be made of the whole before setting out upon the trip. Mr. Wellman does not think it advisable to make the trial tests of the balloon at Paris before taking it to the Arctic regions. At first he intended to do so, but was brought to a different conclusion after considering the matter. Should this be done he could not make the expedition this year, as a balloon shed would have to be built and other arrangements made which would take a great deal of time, and again these tests would not be decisive at any rate, seeing that the airship must be taken apart for transportation for several thousand miles and then set up again. To be sure that all was right, a new set of trials would need to be made on the spot after assembling it. As the airship is designed for use in the Arctic regions and above the ice, the conditions are special, and it would need to be tested on the spot. The new airship "America" will carry quite an amount of load, seeing that besides the machinery and 3½ tons of gasoline there will be four or five men for the crew, about a dozen dogs for the sleds and all that will be needed should they be required to make the return trip on the ice; added to this there are 1½ tons of provisions, so that the crew could pass all the winter in the Arctic regions. The material which is used for the balloon seems to be of first-class quality and according to recent tests made upon it, not more than one per cent of hydrogen would be lost during twenty-four hours. Even should this amount rise as high as two per cent per day, Mr. Wellman estimates that he could continue in the air for about twenty-five or thirty days without difficulty, keeping the balloon swelled out by the interior ballonet. His present plan is to arrive at Spitzbergen during the first week of June and thus to make a series of trial flights during the month of July, leaving for the pole about the first half of August.

Hydrofluoric acid as a cleaning agent for castings has been in general use but a short time, being treated a few years ago as a secret process. Formulæ for the acid containing superfluous and innocuous ingredients to mystify the purchaser have been sold for considerable sums. Anything used in connection with this "pickle," aside from the hydrofluoric acid and water, is wholly unnecessary, the usual formula being one part of acid to ten of water. In adding water, however, care should be taken to know the strength of the acid. The idea is to get a dip that will remove the sand perfectly and quickly, the operation requiring ten to fifteen minutes.

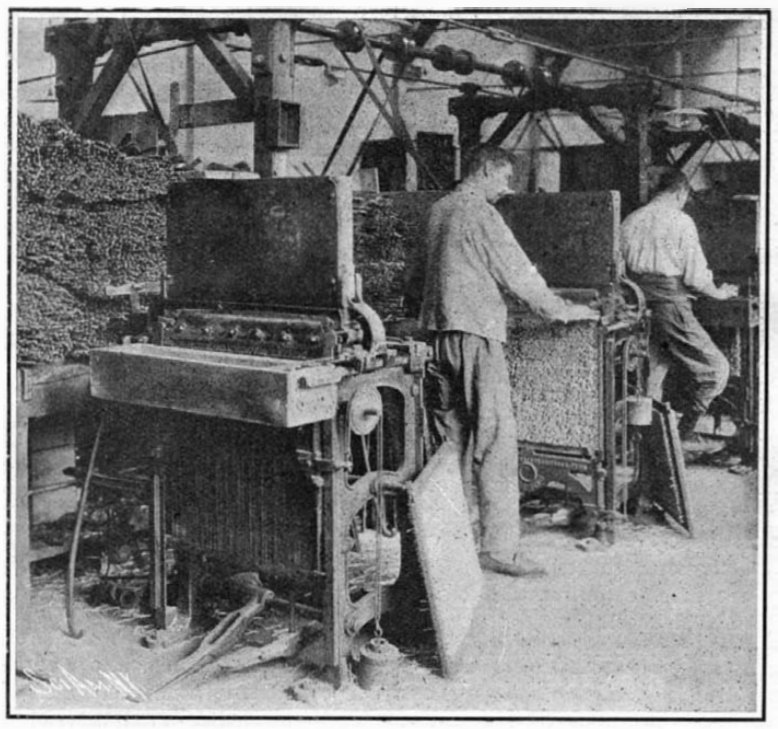
THE MANUFACTURE OF MATCHES IN FRANCE.

BY JACQUES BOYER.

Since 1890 the manufacture of matches in France has been a government monopoly. There are seven national match factories, situated at Pantin, Aubervilliers, Saintines, Bègles, Trélaze, Aix, and Marseilles, each of which has a specialty of its own. The logs are sawed and cut into splints in the little village of Saintines on the edge of the forest of Compiègne; parlor matches come from Pantin and the wicks of wax matches are made exclusively at Marseilles. Two of the most interesting factories are described in this article — Pantin, with its old equipment which will soon be abandoned, and Aubervilliers, recently reconstructed and provided with machinery of the highest perfection. First we will visit the venerable factory at Pantin. The splints come in great boxes from Saintines. The best are made of Russian willow, which is stronger than the French variety. Poplar and birch are also used. The splints are unpacked and laid in a row in a square form called a boat, and this is placed on an apparatus designed to arrange the splints in regular order, separate them from each other and bind them together in a "press" or iron frame. The operator, by pressing a lever with his foot, feeds into the press a row of 100 matches, which he covers with a thin strip of wood to separate it from the following row, formed by the next movement of the treadle. The "press" or frame, balanced by a counterpoise, gradually descends during this operation. When full it is locked by fastening on a headpiece, taken from the machine and carried to the sulphuring room.

In framing safety matches the empty frame is laid horizontally under a battery of vertical tubes surmounted by a perforated plate on which the splints are stacked in a vertical position. Each movement of the pedal causes a splint to descend through each tube to its place in the frame, which is thus filled at one effort. The upper part of the apparatus is then raised and the filled frame is locked and replaced by an empty one.

In the sulphuring room the frames containing the splints, regularly spaced, are first pressed upon hot iron plates which heat the ends of the splints in order to facilitate adhesion of the melted sulphur into which they are next dipped. The depth of the immersion is limited by the contact of the iron frame with the rim of the steam-heated vessel, in which the level of the melted sulphur is maintained constant. Expert workmen are needed for this operation, as too brief or too prolonged immersion may seriously injure or even destroy the value of the product.



Charging the Frames with Splints.

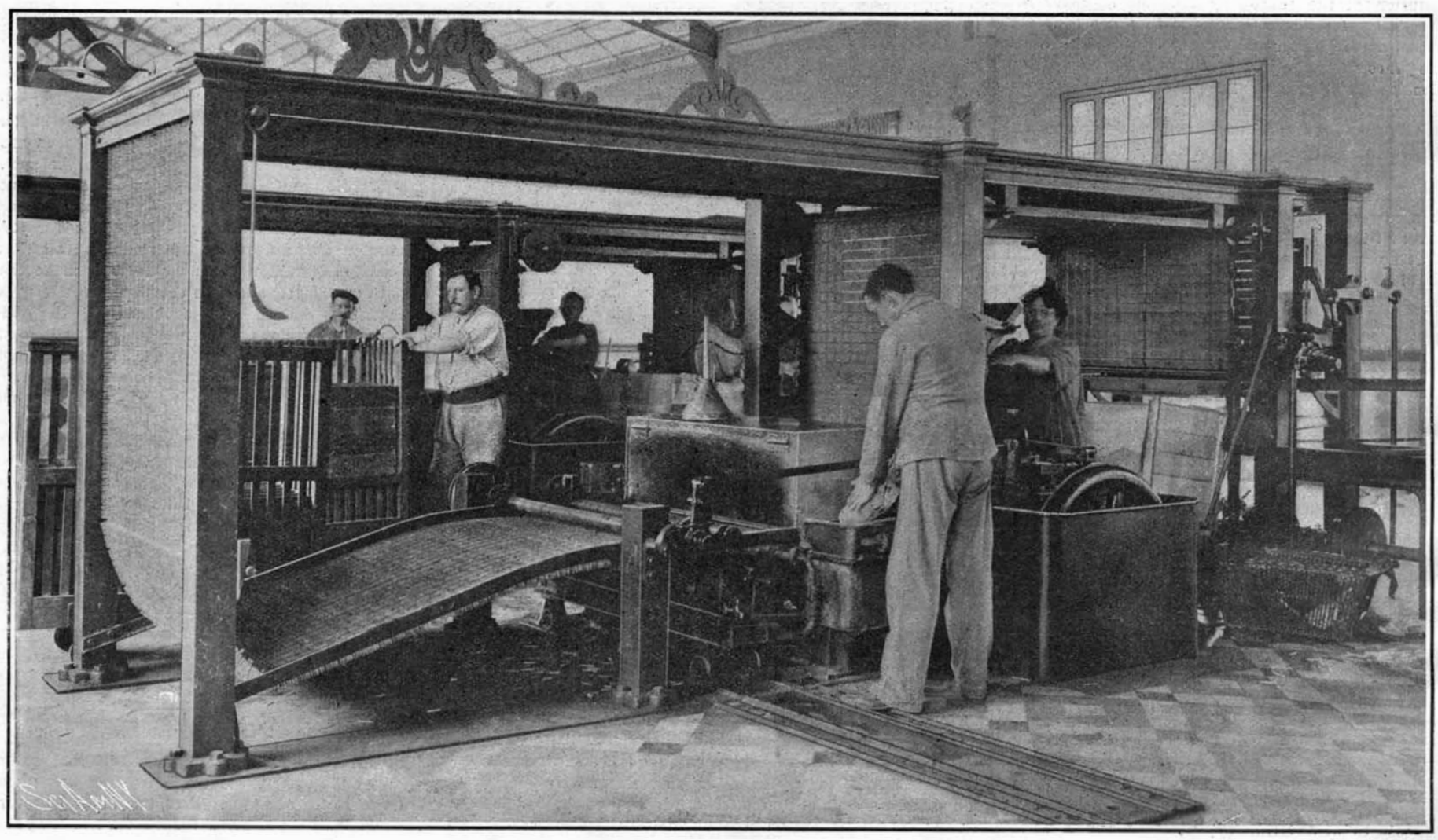
Applying Phosphorus Paste to the Sulphured Matches.

The heads of common matches next receive a coating of phosphorus. The apparatus employed for this purpose consists essentially of a horizontal cylinder which dips into the phosphorus paste to a depth equal to one-third of its diameter and carries a layer of the paste with it as it revolves. The frames filled with sulphured matches are passed between this cylinder and another, at such a distance above it that the sulphured ends are pressed firmly against the paste-covered lower cylinder.

Parlor matches are headed by a single operation which resembles the sulphuring of common matches, except that they are pressed on a metal plate covered with a uniform layer of the chlorate mixture instead of being dipped into a tank. The operation requires much care and skill, for the heads are large and all must be of the same size. In wax matches and all others in which the sulphur is replaced by stearine, paraffine, or some other combustible, a little potassium chlorate is added to the paste to increase the temperature of the flame. The heads of safety matches, which contain neither uncombined sulphur nor phosphorus are made of a paste composed of 100 parts of potassium chlorate, 40 parts of antimony sulphide, 20 parts of gelatine and sufficient water to produce the desired consistence. These matches take fire only when rubbed on the box, which is coated with a mixture of 100 parts of red phosphorus, 80 parts of antimony sulphide, and 50 parts of gelatine. All these pastes, whether they contain phosphorus or not, are prepared in a special laboratory where the ingredients are carefully weighed out and mixed by machines.

The common sulphur matches after receiving their two coatings, of sulphur and phosphorus, are conveyed, still clamped in the frames, on iron cars to the drying rooms. These tunnel-shaped rooms have air-tight doors at each end, and the drying is effected by the combined agencies of steam pipes and energetic ventilation. If fire breaks out it simply consumes the contents of the fireproof room, producing volumes of offensive smoke but doing little damage.

From the drying rooms the cars laden with matches are rolled to the discharging rooms where women open the frames and put the matches into open boxes called "boats," which are divided into small compartments. This operation is performed almost mechanically. The operator places the frame on the apparatus, unloads the frame and removes, one by one, the strips of wood



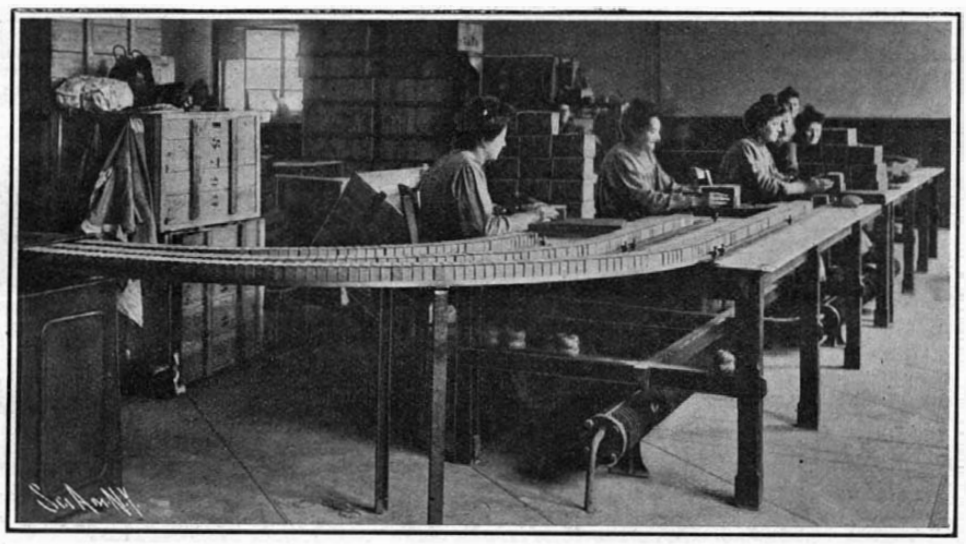
A Machine Which Automatically Converts Splints into Finished and Boxed Matches.

THE MANUFACTURE OF MATCHES IN FRANCE.

between the rows of matches, at the same time pressing a pedal which causes the row of matches just released to fall into the boat below. Another woman turns, with pincers, all matches that have become inverted. The loaded boats are then taken to the boxing room. The boxes for common sulphur matches are made by machine in a neighboring apartment and are brought, piled pell-mell in great crates, to the women in the boxing room, who fill them very rapidly.

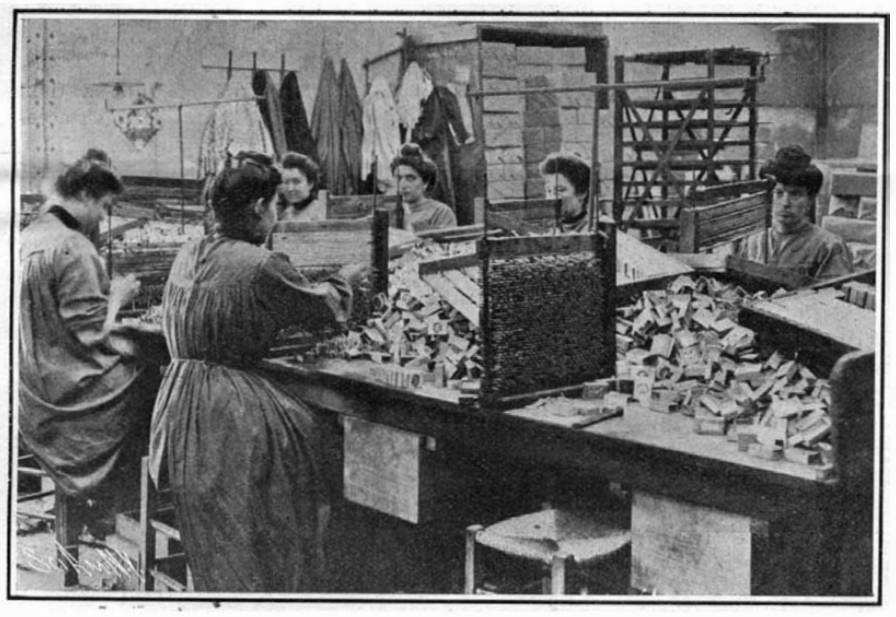
Boxing is also done by machine. In this case the boat is placed behind a glass screen, through which the attendant watches the operation, and is subjected to constant shaking in consequence of which the matches glide, by their own weight, into a tube which holds the number of matches required to fill a box. The attendant empties the filled tube into a box by pressing a pedal and two assistants cover the filled boxes. One machine with its crew of three women can put up, on an average, 20,000 boxes in a day. The packing and labeling of the boxes offer nothing of particular interest except the dexterity of the women who do the work. The boxing of parlor matches is performed in a different manner, as shown in one of the illustrations. Women sit at a table on which the frames of matches are placed vertically. After unlocking the frame the operator takes out with her forefinger and thumb the matches of one row, arranges them on the table and puts them into a box, then proceeds to the next row, and so on. The great inflammability of the matches makes the operation rather dangerous and also makes boxing by machine impossible. Occasionally a match ignites and sets fire to others. The woman must then promptly spring back from the table and sweep to the floor the burning boxes and frame. These little fires are usually extinguished without difficulty, as are those which are caused, now and then, by the parlor matches or other matches which always litter the floor, for dropped matches are of too little value to be picked up as they fall, so they are simply swept up once a day and burned in a furnace provided for the purpose.

The boxes for parlor matches and safety matches are coated on their sides with frictional or chemical compositions on which the matches are to be scratched. These coatings are applied either by hand or by machine. In the former case the box is simply dipped lightly in the phosphorus or other composition; in the latter, the curious machine shown in one of the illustrations is employed. The filled boxes, arranged in rows on three long rails, are pushed by a woman under rollers which drive them forward to rotating brushes which apply the coatings. The boxes then travel onward, automatically, through a drying chamber, to the packing tables where girls put them up in packages.

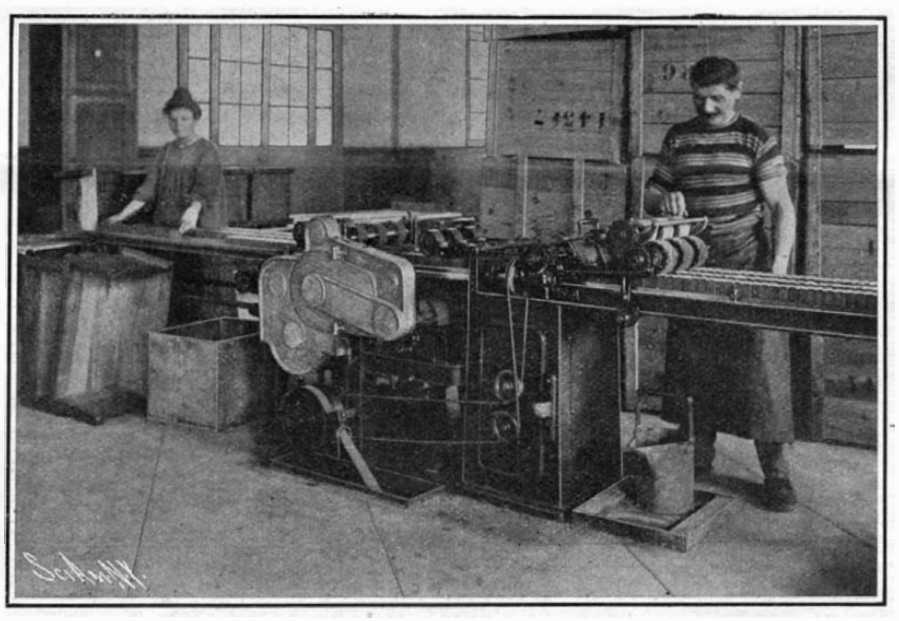


Making Packages of Filled and Coated Boxes of Safety Matches.

Now, having reviewed the successive operations which are required in the manufacture of matches by the old methods, let us examine the remarkable machine invented by MM. Cahen and Sevène which takes the place of many hands, automatically transforming the bare wooden splints into perfect matches and even putting them into boxes. Twenty of these masterpieces of mechanism are employed in the new factory at Aubervilliers, near Paris. A woman feeds the machine with splints while a man sees to the replenishment of the tanks of sulphur and phosphorus composition. At one end of the machine is a funnel into which a girl feeds empty boxes which are quickly filled and dropped before another girl who puts them in a large open crate for transportation to the crating room. The essential part of the match-making machine is the carrier, which in the French industry bears the same name, "*presse*," that is given to the small frame used in the hand manufacture. This carrier consists of a long endless band composed of a great number of steel plates connected by chains and driven forward by toothed wheels and pawls. Each plate is 2½ inches long (in the direction of motion) and 48 inches broad and is pierced with 550 round holes, the diameter of which (1/12 inch) is sensibly equal to the width of a match splint. Hence when the ends of the square splints are forced into the round holes they become fastened very securely to the plates. The holes are arranged in five rows, each containing 110 holes and holding the matches required to fill one box of 100 or two boxes of 50—the excess of 10 per cent having been found necessary to allow for broken

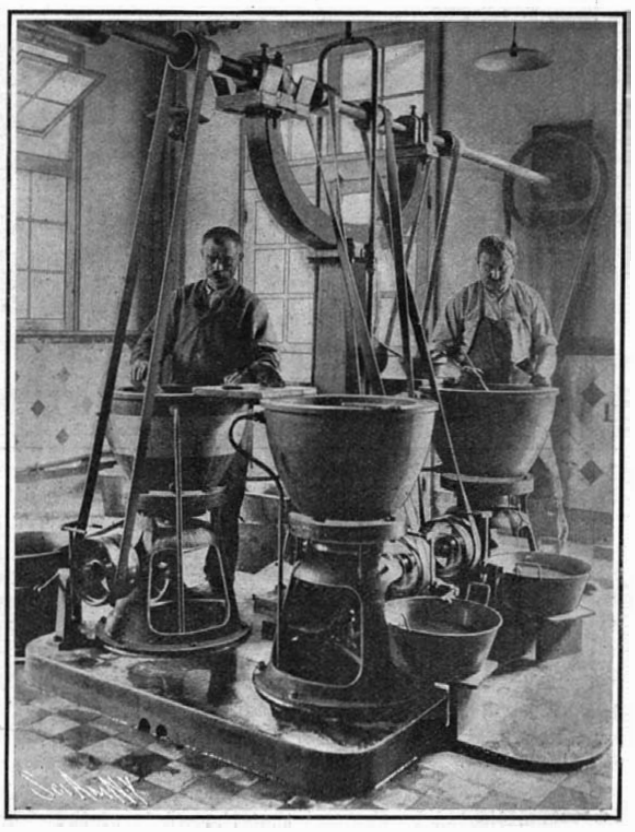


Filling Small Boxes with Safety Matches.



Coating Safety-Match Boxes With Red Phosphorus Composition.

Discharging the Frames.

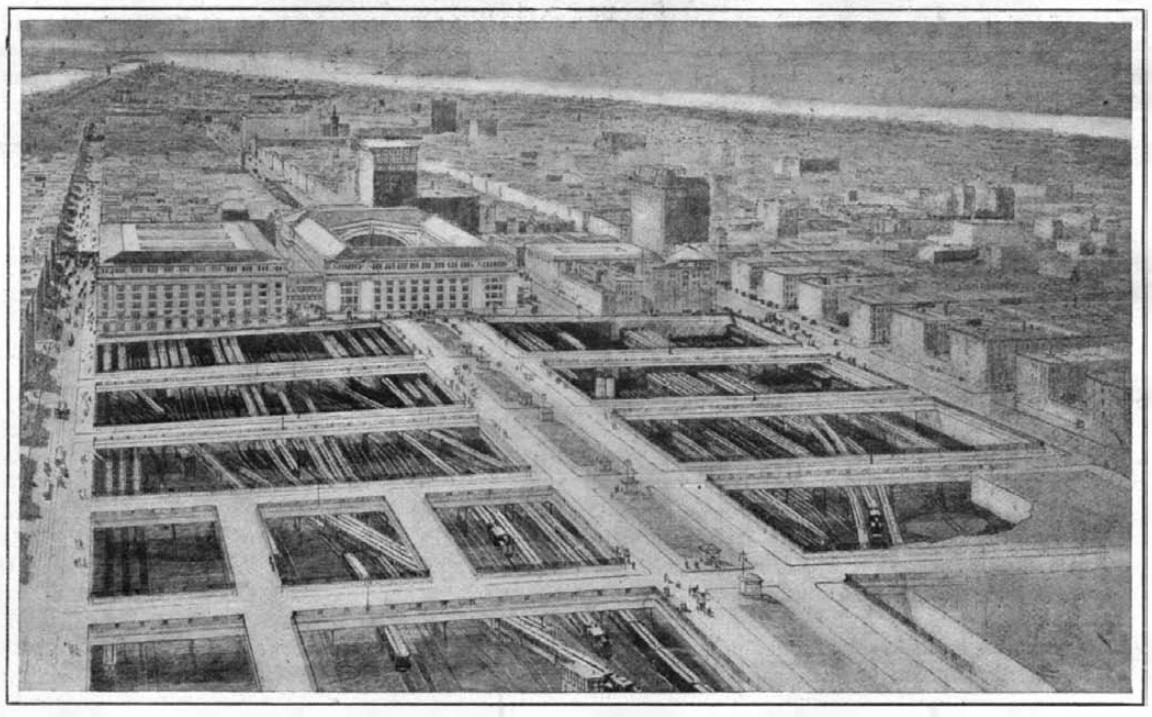


Mixing the Inflammable Coating.

THE MANUFACTURE OF MATCHES IN FRANCE.

or otherwise spoiled matches. The carrier being set in motion is charged with splints in the following manner: The splints fall from an oscillating hopper upon a horizontal iron table bearing 110 parallel grooves. The splints lodge in these grooves from which they are driven by plungers, at each stroke of the machine, into the 110 grooves of a traveling table or charger, which moves to and fro between the fixed table and a vertical portion of the endless carrier. As the charger approaches the carrier a blade rises behind it and prevents the splints from being driven backward. The splints, being a little longer than the charger, project in front of it and are forced into the 110 holes of one row of the carrier plate, where they remain firmly attached when the charger retreats. The force required for this operation is so great that an iron plate is pressed automatically on the splints from above to prevent bending and breaking.

As the carrier travels onward the free ends of the splints with which each plate bristles are dipped successively into a paraffine and a sulphur bath after which they receive their coat of phosphorus from a rotating cylinder which dips in a vessel of the composition. Then they travel a long distance, for the purpose of drying, and finally reach the discharging and boxing station. Here they are expelled from the holes in the carrier plate by minute plungers so controlled by springs that they follow the plate in its motion as nicely as a human hand could do and perform their functions without shock or jar. The matches fall, in groups of five, into little receptacles whence they are pushed by pistons into the boxes, which are mechanically opened to receive them and similarly closed when full. The machine, therefore, does everything, even boxing, human hands merely feeding it with the raw material and removing the finished product. One such machine attended by three girls, turns out about 50,000 boxes, each containing 50 matches, in ten hours—an output which would require the labor of twenty persons in the old method of manufacture.



The new station and yard as they will appear from Fiftieth Street. The broad central roadway is Park Avenue, which will extend to the office and station building. To the left is the new Post Office. The open spaces will eventually be covered by buildings.

THE NEW GRAND CENTRAL TERMINAL, NEW YORK.

RECONSTRUCTING A GREAT CITY RAILROAD TERMINAL.

In a comparison of the problem presented by the construction of the two great railroad terminals which are now being built in this city, one for the Pennsylvania Company and the other for the New York Central, it must be admitted that the New York Central terminal presents the greater difficulties, for whereas the Pennsylvania Railroad station is being built *de novo*, and on a stretch of ground bought for the purpose, and free from any complications save those directly incidental to the construction of the station itself, the New York Central terminal problem is greatly complicated by the fact that the whole of the traffic of two large trunk railroads has to be provided for, and kept in movement, as far as possible without any delay or confusion of its schedule, right upon the very ground where the new station and the complicated yard is being built. The problem would be perplexing enough, in all conscience, did it consist merely in the pulling down of the old and the erection of the new buildings in the presence of the traffic; but as a matter of fact, the difficulties are enormously increased by the fact that the whole surface, both of the station yard and train shed, has to be excavated to a least depth of 15 feet to accommodate the express traffic of the road, and that 25 feet below this level as thus depressed, yet another yard and station must be excavated for the accommodation of the local service. At the present writing the westerly third of this excavation is completed, and the suburban service of the New York Central Railroad is being operated from a temporary terminal station built in this completed portion.

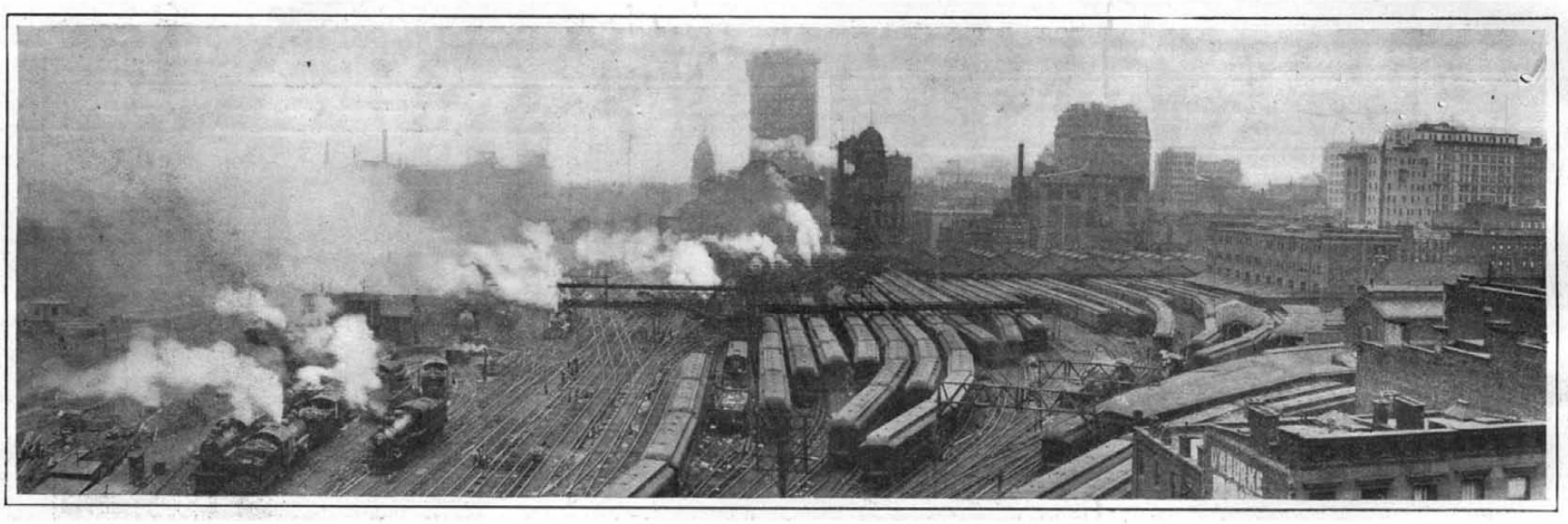
Nor are the difficulties of reconstruction at all assisted by the fact that simultaneously with all this excavation and tearing down and building up, a radical change is being carried out in the methods of traction employed, the steam trains being abolished and an elaborate and costly system of electric traction installed. Moreover, as though this were not sufficient, the company have put upon their engineers the burden also of instituting an entirely new system of signaling suitable to the electrified road.

Apart from the fact that there may be in the long run some slight financial gain from the change of motive power, and that there will be an immediate gain in convenience of operation, the immediate motive for this costly work was the desire to render safe and comfortable the operation of trains through the Park Avenue tunnel, and to abolish the smoke and steam, the noise and odors, incidental to the use of steam locomotives in the terminal yard. There is no doubt whatever that all of these objects will be secured; and by way of illustrating how completely the smoke and steam nuisance will be abated, we present two illustrations which show in a very dramatic way how great will be the improvement. Both illustrations are taken from a point of view near the intersection of Fiftieth Street and Park Avenue. One of them portrays a scene which may be witnessed at any time in the present yard when the condition of the atmosphere is favorable to a slow dissipation of the steam and smoke. The other view represents the conditions as they will appear in the year 1909, when the new yard and station shall have been built, and Park Avenue with the intersecting streets from Fiftieth to Forty-fifth Street have been built above the yard and restored to the use of the city. When this work has been completed there will be a complete absence of steam and smoke, and the loud exhaust of the steam locomotives will give place to the quiet hum of the big electric motors and the multiple-unit trains.

The southerly end of the depressed yard will be covered by the new Grand Central Station proper, whose southerly façade will stretch for 300 feet on 42d Street, and its westerly façade for 680 feet on Vanderbilt Avenue on the west. The building will also extend 625 feet on Forty-fifth Street, 400 feet on Lexington Avenue, 275 feet on Forty-fourth Street, and 260 feet on Depew Place. Of this great block of buildings, the southerly portion will include the station proper, and the northerly and larger half will be taken up by the offices of the company. In the view herewith given, the northerly façade of the office buildings lies to the right. The large building, of similar architectural treatment, to the left, is the new Post Office building, beneath which will extend a portion of the tracks of the upper express level.

The station building proper will include a ticket lobby 90 feet wide by 300 feet long, from which access will be had to a grand concourse 160 feet in width by 470 feet in length, the latter being covered by a vast domed roof, rising at its crown to a height of 150 feet above the floor. Beyond the concourse will be thirty-four stub tracks for passenger trains, with broad platforms, of an average width of 16 feet, between them. On the lower deck will be a separate station for suburban travel, which will be served by fifteen parallel tracks and a two-track loop.

Referring again to the view illustrating the completed station, it will be observed that between Fiftieth and Forty-fifth Streets, the squares which would normally be occupied by blocks of buildings are, for the present, being left vacant. There is no doubt, however, but that ultimately these enormously valuable areas will be covered by office or apartment structures; indeed, the railroad company, in laying out the tracks in the yard below, have been careful to make provision for suitable footings for the bases of the columns of the buildings which will ultimately be put in place when the increased value of this property warrants their erection. When that is done, the entire yard with its hundreds of entering and leaving trains, will be entirely shut out from view, and the noise of the traffic will be entirely eliminated.



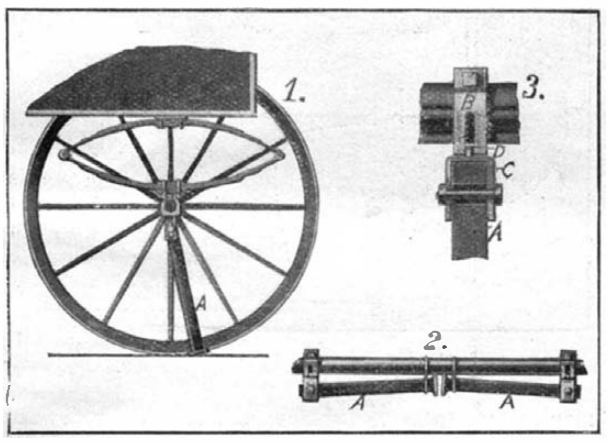
The yard here shown will be lowered fifteen feet; below this will be the suburban tracks. The steam and smoke will disappear with the introduction of electric traction.

VIEW OF THE PRESENT GRAND CENTRAL STATION FROM THE NORTH.

Patent Department

AN IMPROVED VEHICLE JACK.

An improved vehicle jack has recently been invented, which is of a type adapted to be fastened to and form a permanent attachment for a vehicle. The jack is so mounted that it can easily be brought into operative

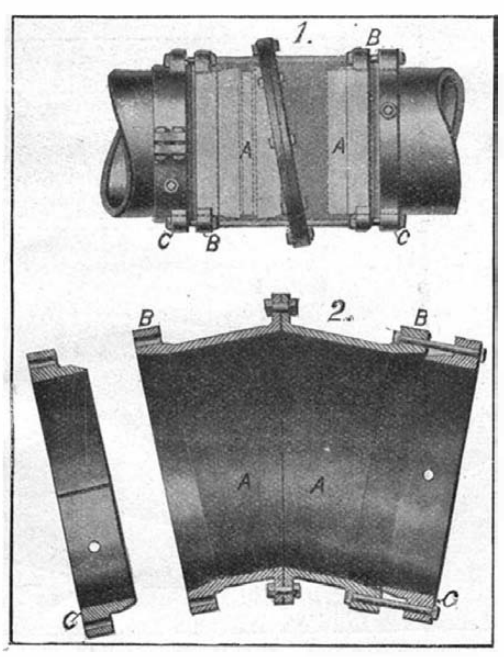


AN IMPROVED VEHICLE JACK.

position, and carried to inoperative position with little work on the part of the operator. In the accompanying engraving the jack is shown at *A*. It will be observed that it comprises two legs hinged to the axle of the vehicle. The method of hinging these legs to the axle is shown in Fig. 3. A collar *B* is secured to the axle, and this is provided with an undercut slot. Each leg *A* is journaled on a transverse bolt in a yoke *C*. The latter is formed with a pin *D* adapted to enter the slot in the collar *B*. The head of this pin *D* engages the undercut portion of the slot. When the jack is not in use the legs are folded up against the axle, to which they are secured by means of hooks, as shown in Fig. 2. In the operation of the jack the legs are detached from the hooks and swung laterally on the pins *D* as a pivot, after which they are dropped downward, turning on the bolts in the yokes *C*. To lift the vehicle wheels it is only necessary to back the vehicle, when the wheels will be raised by the legs. A patent on this improved vehicle jack has recently been secured by Mr. Anthony Gordon, of Sourisford, Arthur Municipality, Manitoba, Canada.

COUPLING FOR LARGE PIPES.

Pipe lines lying on the bed of a river frequently become broken from various causes, such as the dragging of an anchor along the bottom of the river, and when the connecting ends of the pipe sections become broken, it is necessary to cut away a portion of the ends of the pipe and connect the sections together by means of a sleeve, which will make up in length for the portions that have been cut away. This sleeve must be applied when the pipe sections are in their places under water, and the couplings should be so constructed as to enable the pipe sections to lie evenly on the bed of the river, otherwise a continuous strain is exerted on the joint, which is liable to break the joint. The accompanying drawing shows a simple method of making such a connection under water between pipes of large diameter. The coupling consists of two similar cylindrical sleeves *A*, formed with flanges on their adjacent ends, extending in a plane inclined to the axial line of the sleeves. These flanges

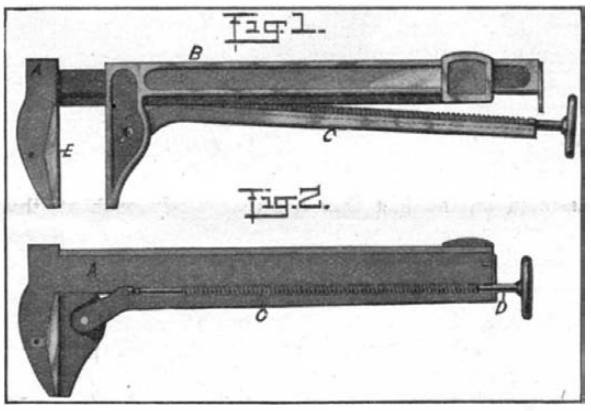


COUPLING FOR LARGE PIPES.

are provided with bolt holes equally spaced thereon, so that the sections may be rotatably adjusted on each other before being bolted together, so as to extend in any line between a straight line and a right angle. In the illustration Fig. 1 shows a straight line coupling, while Fig. 2 shows the method of coupling the sleeves at an angle with each other. This adjustment permits of coupling the sections so that they will conform to the contour of the ground upon which they lie. A series of lugs *B* are formed on the outer ends of the sections. Bolts which pass through these lugs are adapted to engage apertures in similar lugs formed on the sections *C*. The outer ends of each sleeve section and the inner edge of each set ring are beveled. In use a soft metallic packing is placed between the set ring and the sleeve, and is compressed firmly against the end of the pipe section by tightening the bolts which pass through the lugs *B*. A patent on this improved type of coupling has recently been granted to Messrs. Erick T. Christensen and David M. Tulloch, Hanover Square Building, New York city.

QUICK-ACTING WRENCH.

Pictured in the accompanying engraving is an improved wrench of such design that the jaws can be quickly adjusted to the work, after which they may be moved to clamp the work as tightly as may be desired. The wrench consists of a shank *A* with a fixed jaw formed thereon. Fitted to slide on the shank is a sleeve *B*, which is formed with inwardly-projecting flanges adapted to engage a pair of grooves in the shank *A*. At the end of the shank a collar is secured, which serves to prevent the sleeve *B* from being dis-

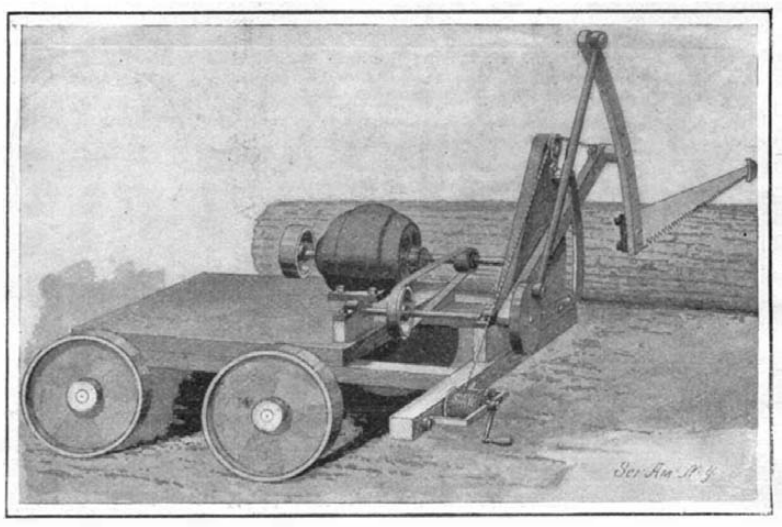


QUICK-ACTING WRENCH.

engaged from the shank *A*. The sleeve *B* carries the movable jaw of the wrench. Pivoted to this movable jaw is an auxiliary shank *C*. An adjusting screw D is adapted to engage a thread formed partly in the main shank *A* and in the auxiliary shank *C*. This screw is provided with a head at its inner end, which is seated in a groove in the shank *C*. In use, when it is desired to move the jaw of sleeve *B* quickly toward the fixed jaw, the shank *C* is swung downward, as shown in Fig. 1, so as to disengage the screw *D* from the segmental thread in the shank *A*. After the jaws have been moved to approximately the position desired, the shank *C* is swung up toward the shank *A* and held in engagement therewith by means of a hook, which is passed around the body of the screw *D*. Thereupon, by turning this screw the jaws may be drawn tightly into engagement with the work. The jaw *A* is provided with a serrated surface adapting it for use as a pipe wrench. In order to convert the wrench into one of ordinary form a plate *E* is provided, which is fitted into the jaw *A*. A tongue formed on this plate projects into a recess in the jaw, and a transverse adjusting screw which passes through the tongue serves to hold the plate firmly in place. Mr. C. M. C. Kirk, of Nahcotta, Wash., is the inventor of this improved wrench.

PORTABLE SAW-OPERATING MECHANISM.

A patent has recently been secured by Mr. W. K. Gordon, of Thurber, Tex., on a mechanism for operating cross-cut saws whereby logs, timbers, trees, or the like may be cut into blocks or lengths while the wood is flat upon the ground. The mechanism is supported on a wheeled-carriage, the wheels turning in planes at right angles to that of the saw so that the carriage may be moved along the log to bring the saw to a new place for cutting. The saw is operated by a gasoline or electric motor, mounted on a carriage.

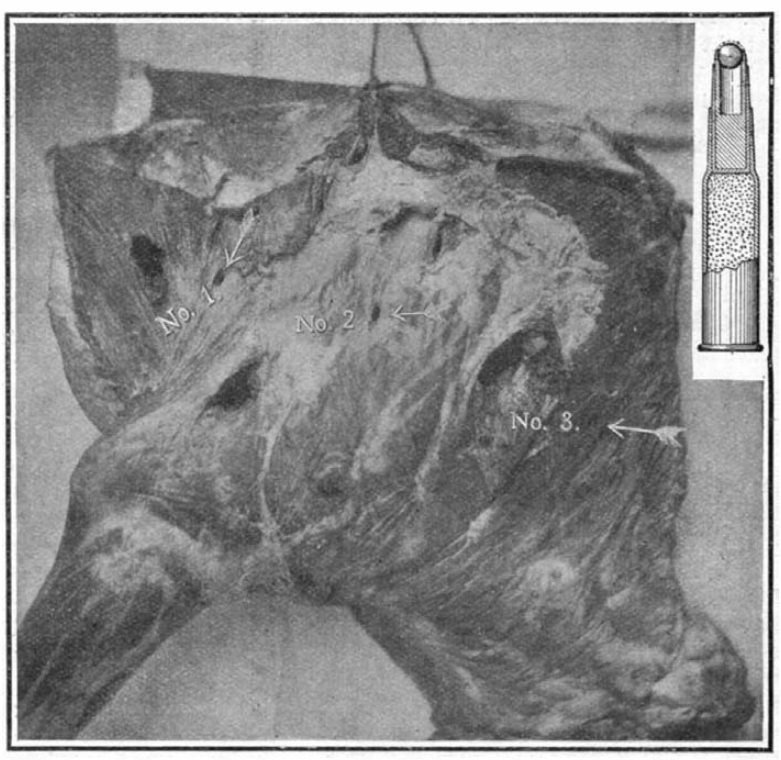


PORTABLE SAW-OPERATING MECHANISM.

The power is transmitted by means of belts and pulleys to a crank shaft on which a disk is secured. A pitman engages a crank pin on this disk and its opposite end is pivoted to a curved or segmental bar. An arm is adjustably pivoted to the bar at one end, while the other end is mounted on the crank shaft. The lower end of the segmental bar carries the saw which is pivoted thereto. A cable attached to the arm passes over a pulley and to a winding drum. This provides means for lifting the saw when it is desired to move the mechanism about, and a stop pin in the bar projects under the saw and prevents it from swinging down to the ground. In operation the machine is placed to bring the saw in position for cutting the log. The ratchet mechanism on the winding drum is then released, permitting the saw to drop down on the log. At the outer end of the saw is a shoe formed with a curved under face. Now, when the motor is operated the pitman will cause the segmental bar to oscillate on the outer end of the arm as a fulcrum, and thus move the saw back and forth. As the cutting proceeds the saw will move downward on the crank shaft as a fulcrum. The shoe on the end of the saw serves first to weight the saw and assist it in its downward movement, and then, by engaging with the ground, to prevent the saw teeth from touching the ground and being injured.

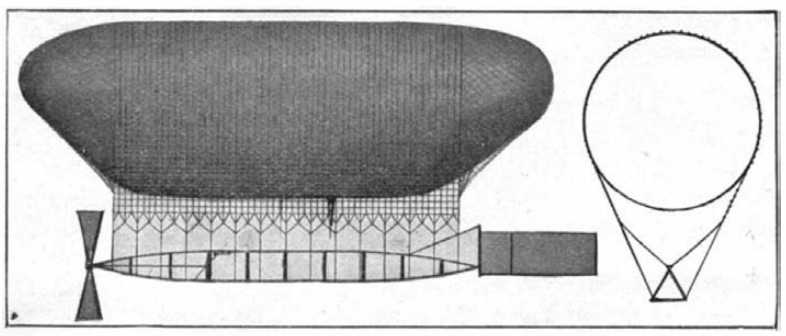
A NEW FORM OF MUSHROOM BULLET.

The small-bore, high-power rifle that is in general use to-day was originally designed as a military rifle, the object of which is to wound or maim at extreme range; and owing to its high velocity, the trajectory is so flat that the raising or changing of sights under ordinary circumstances is unnecessary. Sportsmen, seeing the advantage gained by great velocity, were quick to adopt this type of rifle. It was found that by inverting the jacket of the full metal-patched bullet



A NEW MUSHROOM BULLET AND THE WOUNDS IT MAKES.

so as to leave the soft nose exposed, this bullet when striking hard substances such as bone, will very often mushroom or expand, causing a severe wound. Improvements in powder have from time to time increased the velocity of these bullets until they now have a muzzle velocity of 2,700 feet per second. With this velocity even the soft nosed bullet will pass through the animal without expanding in the least until some hard substance is struck, when it is apt to fly to pieces. The great heat caused by friction in the air causes the bullet to cauterize the veins and arteries, causing little bleeding and thus making it impossible for the hunter to track his game by the blood. It is stated on reliable authority that this year in Nova Scotia over forty per cent of the game hit or wounded escaped, some to die a lingering death in great agony.

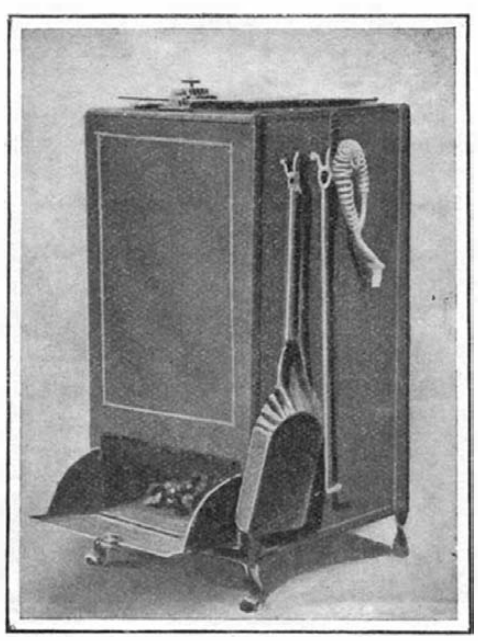


AN IMPROVED NETTING FOR AIRSHIPS.

To overcome these objections to the ordinary bullet, Mr. G. H. Hoxie, 4440 Michigan Avenue, Chicago, Ill., has invented the form of bullet illustrated in section in the accompanying drawing. The bullet consists of a jacket with a filling of lead in which a steel ball is seated. In another construction a steel wedge is used in place of the ball. Behind the ball is a chamber formed in the filling. When the bullet strikes an object the ball is forced into the chamber, expanding it and tearing it open. One of the illustrations shows the character of wounds produced by this bullet as compared with other wounds. The arrows 1, 2, and 3 point to wounds produced by the ordinary soft-nosed bullet. The wounds made by the improved bullet are four or five times larger, and need no designating arrows.

PORTABLE COAL BIN.

The common coal scuttle is a very primitive device, which in nowise meets the requirements of the ordinary household. It is impossible to scoop a shovelful of coal out of it without tipping the scuttle, unless the scuttle be filled to the top, and in the latter case there is danger of spilling the coal over the floor. Furthermore, the scuttle is of entirely too small a capacity to supply the needs of the ordinary kitchen range. This deficiency is particularly felt in flats and apartments; and in order to meet these special needs, Mr. August H. Koch, of 230 West 142d Street, New York, has invented a portable coal bin of sufficient size to receive a sackful of coal, and so arranged that the coal may be shoveled out of it with equal facility, whether the bin is full or nearly empty. The accompanying engraving clearly illustrates the device. It consists of a metal box with a hinged lid at the top, covering the opening through which the coal may be poured into the bin. At the lower end of the bin is an inclined chute or slide, which directs the coal toward the rear. A door opens into the bin at the bottom, and when this is open the coal may be scooped out with perfect ease. The door is formed with side walls which prevent the coal from spilling when it is shoveled out. At the side of the bin is a rack adapted to hold a shovel, poker, etc. It will be noticed that the lid at the top and the door at the bottom render the bin entirely dustproof. Not only is the bin of advantage as a place for storing coal, but it provides a convenient receptacle for trash and sweepings which may be thrown in, and later, as they work their way down through the chute, taken out with the coal and burned.



PORTABLE COAL BIN.

IMPROVED NETTING FOR AIRSHIPS.

One of the difficulties encountered in the dirigible balloon or airship is the tendency of the gas bag to sag in the middle, the gas going toward both ends, thus changing the form of the bag and rendering the airship uncontrollable. To obviate this it has been customary to use a second internal bag or "ballonette." This requires a continuously-operating air pump to keep up the pressure in the internal bag. Capt. Thomas S. Baldwin (Box 78, Madison P. O., New York city), has recently received a patent on a means for preventing this collapse of the gas bag without employing a ballonette. This result he attains by inclosing the bag in a netting, having a square or other form of mesh, which enables the lines of the netting bearing the weight of the frame, to extend truly vertically and to be of equal length. This places an equal strain on the gas bag, practically throughout its entire length, and it retains the bag in its correct form. At its extremities the bag is inclosed in netting caps, which may be of the usual diamond or diagonal mesh and which are connected to the main portion of the netting. The frame of the airship is constructed in triangular cross sectional form and is suspended from the netting by means of hanger lines which reach down to the bottom of the frame. The frame is prevented from undue rolling and is held in the correct position by means of guy lines which pass from the sides of the netting to the upper part of the frame. As shown in the illustration the frame consists of three longitudinal stringers connected at intervals by braces of equal length so that its cross section is that of an equilateral triangle. The peculiar manner of supporting the frame allows a certain swaying thereof, but within well-defined limits.

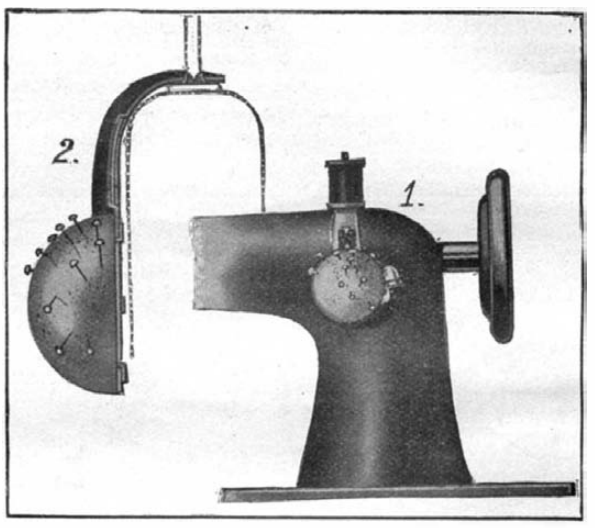
Patents, Trade Marks, and Copyrights in the Panama Canal Zone.

On the secession of Panama from the Republic of Colombia, there was a great deal of uncertainty for a time concerning the status of patent and trade-mark rights and the laws for their protection in Panama, and this uncertainty was made even more annoying for inventors and merchants by the further complications which existed in the Canal Zone by the formal lease of that important strip of land to the United States, with authority on the part of the lessee to govern the leased territory. The Republic of Panama many months ago made provision for the protection of inventions and trade marks, but these enactments did not extend protection to the Canal Zone, which is not under the administration of the Republic of Panama, but is governed from Washington. The Administration, in whose hands the governing of the Canal Zone has been intrusted by Congress, was requested many times to make some ruling which would enable interested parties to protect their inventions and trade marks, but no action was taken until, on March 12, 1907, the Hon. William H. Taft, Secretary of War, issued an executive order extending the United States patent, trade-mark, and copyright laws to the Canal Zone, which has the effect of protecting in that territory, in the names of the legal owners of record, all United States patents, trade-marks, and copyrights issued or registered in the United States. The issue of this order is one more step for the protection of the rights of classes of people who have ever been foremost in the development of trade and the technical and the fine arts.

Tantalum has been hammered into sheets, which are extremely hard. Sir William Crookes, F.R.S., states that "a hole had to be bored through a plate of this metal, and a diamond drill was used, revolving at the rate of 5,000 revolutions per minute. This whirling force was continued ceaselessly for three days and nights, when it was found that only a small depression 0.25 millimeter deep had been drilled; and it was a moot point which had suffered the more damage—the diamond or the tantalum."

ATTACHMENT FOR SEWING MACHINES

The seamstress while seated at the sewing machine finds it often necessary to use pins or a needle and thimble for basting certain parts together, and for this reason Mr. Andrew B. Rosenthal, 872 Clinton Street, Milwaukee, Wis., has devised a simple pincushion attachment which can be readily applied to the ordinary sewing machine. The attachment consists of a plate bent over at the upper end and formed with an aperture, which may be fitted over the usual stud or spool holder. This plate hangs down against the side of the machine frame and carries, at its lower end, the cushion in which needles and pins



ATTACHMENT FOR SEWING MACHINES.

may be inserted. At one side the plate is formed with an upwardly-projecting horn on which a thimble may be seated. Above the pincushion is a piece of sandpaper or emery paper, which may be used in sharpening the points of the needles or in removing any rust therefrom. The cushion is sewed to the plate by passing the thread through slits cut into the plate, and the emery paper is held between a pair of nibs formed on the plate. The device can thus be very simply made, as the principal part is the plate, which may be stamped out of sheet metal. In order that the attachment may fit any size of spool holder, the aperture in the plate is fitted with a rubber washer, on which tongues are formed which fit snugly against the stud.

ROLLER APPLIANCE FOR ROCKING CHAIRS.

A very simple attachment, whereby a rocking chair of the ordinary construction can readily be converted into a wheeled invalid chair, has recently been invented by Mr. E. W. Raymond, of 452½ South Broadway, Los Angeles, Cal. The accompanying engraving clearly shows the construction of the attachment and its method of application. It consists of an axle *A*, on which a pair of rubber-tired wheels or rollers are mounted, and a yoke frame *B* carried by the axle. The yoke frame comprises a long carrying bar parallel with the axle, and having offset ends formed with eyes which are journaled on the axle. In use this simple truck is slipped under the rocking chair, the rockers passing between the carrying bar and the axle. The chair is rocked forward to permit the axle *A* to bear against the rear posts of the chair, while the carrying bar bears against the treads in advance of the axle. In this position the appliance is held by means of a diagonally-disposed tie-rod *C*, which is hooked over the carrying bar and is fastened at its upper end to the seat of a chair. Now, when the chair is tipped back it will be lifted on the rollers. The offset ends of the carrying bar *B* are made longer than the width of the ordinary rockers, and the appliance is thus made to fit different sizes of rockers. When the truck is detached from the chair, the tie rod *C* is folded up against the bottom of the chair seat and is held in place by a hook *D*. The device should prove of especial value for use in cases of temporary illness, when it would not pay to purchase an invalid chair.

ROLLER APPLIANCE FOR ROCKING CHAIRS.

RECENTLY PATENTED INVENTIONS.

Pertaining to Apparel.

GARMENT.—A. BERMAN, New York, N. Y. The object of the invention, which is an improved garment having a special reference to dresses and shirt-waists for children or other like garments, is to so construct the dress or waist that it may be readily and conveniently slipped on and off, especially avoiding the use of buttons or the like attaching devices for holding the garment on the body.

Electrical Devices.

COMBINED LIGHTNING-ARRESTER, FUSE-BOX AND INSULATOR.—R. R. BURRIN and T. F. GAEBLER, Rockville, Ind. This invention relates to electric construction, and its object is to provide a convenient device which will constitute a fuse-box, a lightning arrester and an insulator. By enclosing the fuses and the arrester within a porcelain box, there is no danger from fire in case the fuses burn out or a lightning bolt passes through the device.

PARTY-LINE TELEPHONE SYSTEM. — F. VOLLMER, Winsted, Minn. This improvement relates to telephone systems of the general type represented in that described in Mr. Vollmer's former patent and used for selective signaling between stations. Further, it relates to providing such a system with an automatic time-controlled cut-out, whereby the system after use will return automatically to its normal condition within a predetermined length of time.

KICK-BOARD.—W. H. NICOLAY, New York, N. Y. This board is designed to be applied to a base board adjacent to the floor, and the object of the inventor is to provide means adapted to inclose and protect insulating tubes which extend through the floor boards for the purpose of receiving electric wires passing through the floor, thereby protecting the woodwork from the wires.

SPARK-ARRESTER. — C. S. CHALFANT, El Paso, Texas. The design in this case is to provide a device which will enforce the economical consumption of fuel, eliminate danger and discomfort caused by escaping sparks and cinders, and increase the efficiency of the locomotive by dispensing with the usual obstructing screens, nettings, etc., detrimental to good steaming qualities. The invention provides an arrester which will not choke the draught in the smoke box and thereby cause the blowing of smoke and fire out through the fire-box door into the cab.

ELECTRIC SIGNAL.—E. LIONAIS and W. T. SUTTON, Montreal, Quebec, Canada. In this patent the invention has reference to electric signals, and more particularly to a system for ringing one or more electric bells from a distance. It further relates to a system in which a relay is employed for controlling a bell and in which a single battery is used for energizing the relay and for operating the bell.

KEYBOARD TELEGRAPH-TRANSMITTER.—G. M. GODDARD, Rutland, Vt. The invention consists in the construction and arrangement of the train of mechanism which by the operation of the keys causes the proper opening and closing of the circuit to produce dots and dashes representing the particular key struck. The mechanism may be applied to a typewriter, whereby at the same time a Morse signal-message may be sent and a duplicate of it in type-printed letters may be made at one operation, means permitting the transmitter to be used without printing on the typewriter or the latter used without the transmitter, or both used together.

Of Interest to Farmers.

COTTON CHOPPER AND CULTIVATOR.—J. B. FARRAR, Wilmington, N. C. The invention is an improvement in the class of cotton-choppers in which a disk, or wheel, provided with knives is rotated for cutting out and thus spacing the planted cotton. The inventor has devised improvements in the chopper proper and in attachments for breaking or pulverizing the earth about the roots of the plants.

Of General Interest.

COMBINED SETTEE AND BERTH.—G. S. SHERMAN, Nyack, N. Y. This combination is particularly adapted for use on yachts or other water craft, or, it may be used under other conditions, the object being to provide a device that will take up no more room than the usual settee or bed, the construction being such that the apparatus may be easily and quickly converted from one use to the other.

RECORD-CALENDAR. — F. H. RICE, Oakland, Cal. The purpose of the inventor is to provide a calendar adapted to serve as a reminder of transactions to be attended to in the future, and which takes the place of the customary daily journal, the advantage being that in entering any subject requiring attention at a certain time of the month, one entry will carry for all time, whereas in a daily journal twelve entries are required each year for monthly matters.

PILE STRUCTURE.—J. T. PYLE, Amarillo, Texas. The invention pertains to improvements in structure formed of sheet piling driven into sand or soft earth and having the inclosed material removed, whereby the pile may be filled with concrete to serve as a foundation for bridges, buildings, and the like. The walls of the structure are made up of a large number of sections which are driven into the sand or soft earth one at a time and each succeeding one upon being driven becomes locked to the last one inserted.

BALE-TIE.—A. K. KLINGENDER and DEW. M. COINER, Statesville, N. C. The invention is especially designed for use in securing small packages of papers, such as a series of checks, together. It is also applicable as an improved tie binder for cotton and other heavy materials in bales, the buckle being made of sufficient weight to supply the necessary strength for such service.

FENCE OR DIKE.—J. W. HUMPHREY, St. Johns, Ore. This invention has reference to fences and dikes, and the object in view is to construct a fence or dike in a simple manner, so that it may be readily erected, and to arrange the parts so as to allow for contractions and expansions due to temperature changes and other causes.

APPARATUS FOR PROCESSING SUGAR-CORN.—L. S. FLECKENSTEIN, Easton, Md. In the present patent the invention is an apparatus designed and adapted for processing canned sugar-corn, or like products, by a continuous method whereby the result is effected much more quickly and economically than by the apparatus and methods ordinarily employed. By the use of this apparatus, sugar-corn and like products may be processed without the aid of hand labor.

EGG-LIFTER.—C. F. SWANSON, Eagle Bend, Minn. The invention pertains to improvements in devices for lifting eggs from a crate for the purpose of transferring the eggs to a tester, and returning the same to the crate after testing, the object being to provide a device by means of which all of the eggs in a layer in the crate may be simultaneously picked up.

CHAIN-LINK SHACKLE.—G. A. H. DRESLER, 25 Karlstrasse, Kiel, Germany. The object in this invention is to so contruct the parts of the connecting shackle that the means for fastening the closing part to the link will be subjected to but little strain, speedy release and opening is possible, and shocks exerted upon the closing member from outside are kept from the stud ends of the links.

RECEPTACLE FOR POWDER.—F. H. ABBOTT, Crystal Falls, Mich. The purpose of this invention is to provide an efficient and inexpensive device which will securely retain the powder or like substance when not in use, and at the same time permit the contents to be readily dispensed therefrom in small quantities. It is especially useful in connection with cans for tooth powder.

MOLD FOR CONCRETE POSTS.—J. P. DONOVAN, Georgetown, Ky. The object in this improvement is to provide a mold for making concrete posts, such as are more especially used in the construction of fences, the mold being arranged to permit the production of posts in an economical manner, the posts combining strength with lightness, and not likely to warp or crack.

MOISTENING ATTACHMENT FOR DENTAL ENGINES.—G. BARTLETT, Lenapah, Ind. Ter. The invention relates to improvements in dental engines, and more particularly to means for moistening the disks, burrs, or drills while they are being used. By slightly opening a valve, water is delivered to the tool and the ground material washed away from the tooth operated upon, and the tool may be prevented from becoming heated to an uncomfortable temperature.

VAGINAL DOUCHE.—E. J. LAMPORT, Cape Town, Cape Colony. This douche can be inserted in the canal in a collapsed state and then inflated so as to straighten out and render the folds of the parts smooth, whereby the liquid introduced through the instrument and flowing under pressure between the inflated wall of the instrument and opposing wall of the organ will thoroughly wash and disinfect all of the membranes.

BOTTLE-STOPPER.—H. MORGAN, Cripple Creek, Col. This invention has reference to a closure for beer-bottles, mineral-water bottles, etc., and has for its object the provision of an inexpensive device easy to apply to the bottle and easy to remove, but in which there is no liability of its being accidentally displaced by internal pressure or rough handling.

TEMPORARY HOLDER FOR SAFETY-RAZOR BLADES.—D. A. MACBETH, New York, N. Y. One purpose of this invention is to so construct the device that the holder proper will be practically in one piece, the only other factor employed being a clamp mounted upon the jaw-section of the holder, and, further, to so construct the section that the blade can be quickly and conveniently introduced between the jaws in such manner that the blade will remain in set position while the clamp is being applied.

ADJUSTING CLOCKS AND WATCHES TO CHANGES IN TEMPERATURE.—S. KAHAN, New York, N. Y. The object in this instance is to provide means for varying the length of the suspension-feather of a pendulum, or the hair-spring of a watch, or the oscillating member of any other form of timepiece, so as to offset the variation in length caused by changes in temperature.

FENCE-POST.—E. D. MINER, Rathdrum, Idaho. Among the objects of this inventor is the provision of a device both strong and durable, on which fence-wires are to be strung and which can be easily and readily set in position and the wires assembled therewith or disassembled, and the post dismounted when the fence is to be removed or shifted to a different position.

MAKING CONCRETE WALLS.—F. M. JACKSON, Akron, N. Y. The inventor provides improvements in making concrete walls for buildings, whereby the wall can be quickly and cheaply constructed and when finished is provided with an airspace at the back, and the front face of the wall has an ornamental appearance, thus rendering the wall very desirable for use in the construction of chimneys, fireplaces, and the like.

METHOD OF TREATING GLASS.—W. E. HEAL, Coffeyville, Kan. In the present patent the improvement has reference to a system for treating glass, Mr. Heal's more particular object being to draw the glass into flat sheets suitable for commercial use, and to enable the sheets to be made cheaply, and yet to be comparatively free from imperfections.

CIRCULAR-DISTRIBUTER.—R. G. FRASER, Philadelphia, Pa. The principal objects here are to provide for effectively pressing circulars and the like into such a position that they can be readily abstracted from the distributer by the public without necessitating any complicated manipulation of the parts, and especially to provide means whereby only one circular can be removed at a time. For this purpose a special form of envelope has been designed for containing the circulars, which can be used with the remainder of the device with advantage.

VALVE.—A. L. DOW, Lyons, Col. This invention pertains to improvements in valves, and especially in hydrant-valves, whereby the valve and valve-seat may be removed from the casing without disconnecting the latter, should it become necessary to repair or replace any working parts. This is of particular value around hydrant-valves, which are usually so located that it is very difficult to get at the valve to repair it.

COUNTER-STOOL.—W. G. WINANS, Spokane, Wash. The inventor seeks to avoid some of the objections incident to stools in common use—such, for instance, which are permanently fastened to the floor, where they cannot be readily removed, and others fastened to the front of the counters, where the weight of persons sitting on them exerts a certain strain on the counter sufficient sometimes to tilt the counter. He provides a revolving stool which can be adjusted as to height, easily removed, adjusted to position for use or up against the counter out of the way.

GATE.—W. M. WATSON, Brantford, Ontario, Canada. The gate may be operated in a vehicle without dismounting and similarly closed after the person has driven through. It may be raised to swing over stones or obstructions, but when closed may rest close to prevent small animals from crawling under. It may open in either direction, but be automatically prevented from swinging past the closed portion when being shut.

Hardware.

BELT-TOOL. — E. E. BARNETT, Kremlin, Oklahoma Ter. The improvement is a belt tool having means for punching and cutting holes in the ends of a belt such as are generally provided to receive the lacing; also embodying in its construction a device for drawing the lacing through these holes in the belt, and lacing the ends thereof together.

PUNCHING IMPLEMENT.—J. W. SPENA, Wakeeney, Kan. The object of this invention among others, is the provision of a strong, powerful, hand-operated punch for punching holes in sheet metal and other materials. The punching or cutting tool is mounted in the implement in a manner to at all times remain normal to the work during the punching operation.

PLIERS.—G. G. WORSTALL, Toms River, N. J. The object of the improvement is the provision of a pair of pliers, more especially designed for the use of jewelers, and arranged to permit convenient and quick drawing out and shaping of the claws on new or old settings of the Tiffany, skeleton, or other type.

Heating and Lighting.

GAS AND AIR BURNER.—D. COOLEY, Galena, Kan. This burner is designed for use in heaters, furnaces, and the like arranged to cause a thorough mixing of the gas and air previous to ignition of the mixture with a view to insure a complete combustion of the mixture, the arrangement also permitting independent regulation of the supply of gas and air according to the richness of the gas.

Household Utilities.

WASHBOARD.—S. B. COOK, Laurel, Miss. Mr. Cook's invention is in that class of boards whose scrubbing surface is formed of a series of rectangular bars arranged transversely and held detachably in the side bars of the frame. One of the washboards of this invention is equivalent to four of the ordinary kind. A new set of bars can be supplied at trifling cost when the four corners of the scrub bars are worn off, rendering the board practically new.

SAD-IRON.—J. E. AUSTIN, Binghamton, N. Y. This iron is heated by burning gas, and the design is to provide an iron which is simple and arranged to insure a uniform heating with a mimimum consumption of gas and to produce a complete combustion of the gas, to render the use of the iron very economical and practically odorless.

WASTE FOR BATH-TUBS, BASINS, AND LIKE FIXTURES.—P. F. GUTHRIE and T. HAYES, Nutley, N. J. The invention provides a waste or outlet for bath tubs, basins, etc., arranged to insure a free outflow of the water from the tub, basin or like fixture, and without danger of the outflowing water becoming air-bound, and prevents foul air rising in the waste and passing into the room in which the fixture is located, thus rendering the fixture completely sanitary.

MOP-WRINGER.—J. L. POTTS, Ithaca, Mich. This improvement pertains to washing and scrubbing; and its object is the provision of a new and improved mop-wringer arranged to permit of conveniently and quickly placing the mop in position between the mop-wringing rolls to insure a proper wringing of the mop.

STOVE OR FURNACE ATTACHMENT.—L. D. MOHLER, McPherson, Kan. This inventor provides an unfailing draft from the grate of a stove or furnace upward into and through fuel, effectually preventing smothering of the fire in the use of slack, coal dust, or similar fuel; also conducts air above the fuel to carry away surplus gas, and thus prevent an explosion, and, further, operates to deflect air conducted above the fuel across the top of the fire, with such clearance above the fuel as to employ the air for combustion of gas and smoke in the combustion chamber and hold the heat downward and so spread the products of combustion for the purpose of warming the floor.

BED.—L. H. FLANDERS, Memphis, Tenn. The mattress-frame being in position and each bevel-gear in mesh with respective bevel-gears, rotation of a shaft will move all the slides upward, thus moving the frame in its entirety and with sections in alined position. To raise the head-section to bring the patient into sitting position with legs extended, the gears actuating the slides connected with two frame sections are moved out of mesh by means of levers, when rotation of the shaft will move the head-section into angular position with respect to other sections.

STEAM-COOKER.—C. S. EPPLEY and M. E. STONESIFER, York, Pa. The cooker comprises a casing divided into an upper steaming compartment and a lower baking compartment. Doors give ready access to the compartments. The bottom of the baking compartment is raised above the casing bottom, affording boiler space beneath it for the heating branch of the boiler and bottom plate of the casing, which forms, with the bottom of the baking compartment, the boiler chamber at the casing bottom in which the heat accumulates surrounding the heating branch of the boiler.

IRON-HOLDER.—MARIE AGNEESSENS, New York, N. Y. In ironing certain materials an objectionable glossy appearance is given. This has been overcome by holding the iron in an inverted position and drawing the material back and forth across its face. The invention provides a simple device for sustaining the iron in an inverted position, leaving the handle easily accessible in placing the iron on the holder or removing it.

Machines and Mechanical Devices.

CASH-REGISTER.—T. H. HARRIS, Fredericksburg, Va. This apparatus is for use in shops, stores, warehouses, etc., for registering sales of goods and the amount paid therefor, and also for receiving and holding the cash or vouchers deposited in payment. It is a simple and effective substitute for the expensive cash registers which are in general use, and has marked advantages over them in respect to furnishing a complete record of sales or other transactions.

MACHINE-ROLLS.—C. F. STEIBER, New York, N. Y. This invention relates to machine rolls, and the object is to produce a machine which is especially adapted for rolling the parts of metal stair cases. In this connection, the invention is most useful in forming stringers, risers, and similar parts having flanges which project in opposite directions.

CONCRETE-MEASURING MACHINE. — A. F. NIMS, Philadelphia, Pa. One purpose of the inventor is to provide a machine for measuring concrete or concrete mixtures, or the like, and for delivering the measured material to any desired receiver; which machine is portable and low, enabling material to be easily shoveled into it or dumped therein from wheel-barrows with the assistance of low platforms.

CONCRETE-MIXING MACHINE. — A. F. NIMS, Philadelphia, Pa. Of the several purposes of this improvement, one is to provide a machine which will thoroughly mix material in a very short time and one in which the material may be permitted to remain in the machine for any desired length of time, or be released at intervals, or at any proper time.

WAVE-MOTOR.—J. W. NEAL, Kelia, Ter. of Hawaii. This invention relates to wave motors particularly adapted for use in deep seas, the object being to provide a deep sea motor so constructed as to respond readily to the movements of the water, such as waves and swells coming from every possible direction, and by means of which air is compressed and conducted to machinery on shore as a motive agent.

MECHANISM FOR PROPELLING VEHICLES OVER LAND AND WATER.—J. A. HILDEBRAND. Olympia, Wash. The invention

pertains to certain improvements in mechanism adapted to be applied to boats, vehicles, and the like, whereby they may be propelled with equal facility over the surface of land or water. The intervention of streams or lakes would in no way impede the progress of a traveler were his vehicle equipped with this device.

CONTRACTIBLE MOLD.—G. Georgenson and J. E. Hennen, Fond du Lac, Wis. This flexible mold is for use in the construction of arches, culverts, sewers, or the like in which a temporary support is required for the cement, brick, or stone employed in the construction. In carrying out the invention what may be termed a "cylinder" is employed, the same being formed of sheet metal and provided interiorly with means for expanding and contracting it.

AIR-SHIP.—J. Shukwech, New York, N. Y. The ship has a main deck mounted on a supporting means for sustaining the weight of the ship when on the ground and maintaining it in an upright position when in flight. Wings are pivoted at each side of the ship, connected with suitable means for oscillating them, and propellers are journaled at each side of the bow of the ship and act to direct a current of air under each of the wings in driving the ship forward, which currents tend to force the wings upwardly.

LAWN-CLEANER.—C. H. Mosher, Salisbury Mills, N. Y. The object of this invention is to produce a machine which is of simple construction and which can be readily moved across a lawn in the manner of a lawn-mower, operating at the same time to pick up any articles which may pass under it and which may be operated by horse or motor power.

FABRIC-TESTER.—R. C. Harris, Roselle, N. J. The invention relates to improvements in devices particularly designed for testing the strength of paper, the object being to provide an instrument of this character that will be of comparatively small and compact form, so that it may be carried in a person's pocket and operated by hand pressure.

Prime Movers and Their Accessories.

VALVE.—A. Simpson, New York, N. Y. In this instance the invention relates to valves such as used in pipe systems. The valve is intended to be used for water, steam, gas or other fluids. The object is to produce a valve of simple construction which will be well adapted to maintain heavy pressures and which will reduce tendency to leakage.

AUTOMATIC STEAM-TRAP.—W. Austin, Scranton, Pa. The aim of this inventor is to produce a device which may constitute an accessory for a steam pipe system, and which will operate to collect the water of condensation, and expel the same automatically and periodically without allowing any escape of steam

Railways and Their Accessories.

CAR-WHEEL.—R. P. Williams, Santa Barbara, Cal. The invention consists of a cast metal wheel having the flange thereof so formed that in case it becomes broken the broken part will not become dissevered but will present a ragged edge extending outward at an angle to the normal plane of the wheel, whereby an air valve of the brake system may be operated. The valve is so constructed that should the car wheel become broken the brakes will operate to immediately stop the train.

AIR-BRAKE ATTACHMENT.—R. P. Williams, Santa Barbara, Cal. This invention relates to improvements in air brakes for railway cars, and more particularly to means for automatically operating the brake in case that the truck of any one of the cars becomes derailed. The object is to provide means whereby any variation in the plane of the car track in respect to the car body will automatically open a valve of the air brake system and cause the instant application of the air brakes throughout the train.

RAILWAY-SWITCH MECHANISM.—O. A. Krug, Cincinnati, Ohio. In this patent the invention has reference to improvements in railway switch mechanism, the object being the provision of a simple means whereby an open switch may be automatically closed by an approaching train in either direction, thus preventing possible accident.

RAILWAY-TIE AND RAIL-FASTENING.—A. Newell, Guadalajara, Mexico. The improvements are in ties for railways and rail fastenings, and the object of the inventor is to provide a metal tie that will be comparatively light, yet strong and serviceable, and further to provide a fastener that may be readily adjusted to the rail and normally hold the same from any lateral movement with relation to the tie.

STANDARD FOR LOGGING-CARS.—C. H. Allen, Aycock, Fla. The design in this case is to provide a standard which is to be arranged on the ends of the transverse bolsters of the car to prevent the logs from rolling off when in transit, but which is capable of adjustment to permit the easy loading or unloading of the log.

BLOCK-SIGNAL SYSTEM.—J. Van Zandweghe and L. Viberti, Rosario De Sante Fé, Argentina. In this patent the invention refers to block signal systems, the more particular objects being to provide efficient means for stopping trains automatically when they approach each other within certain limits, and also for stopping them if desired when they approach a station.

Pertaining to Recreation.

GAME APPARATUS.—L. J. Castonguay, Thompsonville, Conn. The object in view is to provide in this invention a game apparatus, more especially designed for playing parlor base ball, and arranged to require considerable skill on the part of the players to successfully play the game, and to afford amusement for the players as well as the onlookers.

Pertaining to Vehicles.

WHEEL-HUB.—F. F. Unckrich, Galion, Ohio. In the present patent the invention has reference to an improvement in wheel hubs, and it has for its object the provision of a metallic shell and the means for securing the shell in a fixed position upon the hub in a most efficient manner.

VEHICLE RUNNING-GEAR.—P. Richardson, Kennebago Lake, Maine. Withstanding the shock of very rough roads and avoiding its transmission to the occupants, in this case, is accomplished by providing for the yielding in all directions of an upper frame on which the body of the vehicle is mounted, as by a system of springs comprising upright springs for yieldingly maintaining the weight of the body and the occupants and diagonally-extending longitudinal and transverse springs for admitting of a yielding end and side movement of the body, respectively.

TRACTION-ENGINE STEERING-GEAR.—R. Richardson, Yates Center, Kan. The gear is designed particularly for use in connection with traction engines, but applicable in other ways. It may be applied to automobiles and all motor vehicles with equal ease, the shaft being either the crankshaft of the engine or some continuously rotating shaft driven from the engine.

DUST-COLLECTOR FOR WHEELED VEHICLES.—J. M. Weaver, New Oxford, Pa. The invention relates particularly to improvements in attachments for automobiles or similar vehicles for receiving dust rising from the vehicle wheels and discharging the same in a wet or condensed condition, thus obviating the annoyance from the spread of dust incident to such vehicles as ordinarily equipped.

Note.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

Buyers wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(10521) O. J. S. says: 1. Which telephone lines do you consider to give the best service in rural districts—ground or metallic? Can you advise me a good book on practical ground line telephony? A. A metallic circuit is best for all telephone lines, but the cost is so much greater that the grounded circuit is usually employed upon rural circuits. Long-distance lines are always metallic. The best book upon the telephone is Miller's "American Telephone Practice," which we send for $4. 2. How do you find the distance between the earth and the sun? Give me a simple formula for calculating that distance. A. It is a long story to tell how the distance of the sun from the earth is found. Consult any college astronomy in the University library. The distance is computed from the parallax of the sun. 3. If the radius of a certain pulley is 4 inches and of another is 12 inches, and the distance between their centers is 6 feet, how would you calculate the length of a belt running around these two pulleys? A. The length of the belt you desire will be given with sufficient exactness by adding to 12 feet one-half the circumference of each of the pulleys. 4. Where, for good ventilation, should a ventilator be situated—near the top or the bottom of a wall? Is it better to have two ventilators one in one corner and another diagonally across? A. There are all sorts of opinions upon the location of ventilators. The usual practice is to place them both at the top and bottom of the room, so that either register may be opened. We do not think one ventilator in one corner and another in a diagonally opposite corner should be preferred. 5. How do you find the horse-power of a common steam engine? A. To find horse-power of a steam engine, multiply the mean effective pressure in pounds per square inch by the length of stroke in feet and by the area of the piston in square inches, and by the number of single strokes per minute. If the piston passes through one end of the cylinder head, subtract one-half of the area of the piston rod from the area of the piston; but if it goes through both ends of the cylinder head, subtract the whole area of the rod from the area of the piston. Divide the product of these numbers by 33,000.

(10522) E. B. S. says: To render theaters safe from fire, a policeman should be on the stage near the curtain, having in his hands or close by one hose containing water under pressure and another hose with carbonic-acid gas under pressure. Either one can be instantly used if necessary. A scientific book says one quart of water resolved into its elements gives 1,200 quarts of hydrogen and 600 quarts of oxygen. Is it correct? If not, how much gas will result of each kind? A. With reference to the suggestion you make that a policeman should be in a theater to guard against fire, we would say that in all New York theaters firemen are on duty all the time when an audience is in the building, ready to turn on the water and use the appliances for extinguishing a fire. A fireproof curtain would be dropped in an instant, and a rope cut, which would open large scuttles above the stage, so that any smoke upon the stage would be drawn up as by a chimney into the open air, and no fire or smoke would or could be drawn out into the house where the audience is seated. The statement is correct that two quarts of water contain 1,200 quarts of hydrogen and 600 quarts of oxygen, when the barometer is at 30 inches and the thermometer is at the freezing point, or 32 deg. Fahr. Unless the pressure and temperature are stated, any statement of quantity of the gases is meaningless.

(10523) L. A. C. asks: Why does not a submarine boat sink all the way to the bottom of the ocean? I understand the method used in plunging submarines is to admit water into tanks, so as to give the boat more weight, weight enough to cause the boat to sink only 50 or 60 feet. It sinks at the surface. Why does it not sink to the bottom? Would a hollow steel ball weighing 65 pounds and having a displacement of one cubic foot (when under a pressure of 4,600 pounds per square inch) sink to the bottom of the ocean, where a cubic foot of water weighs 66.56 pounds (27,366 feet below surface)? I should say that such a ball would sink to a depth of approximately 10,300 feet and there remain suspended. Am I right or wrong? What is the principle involved in the toy known to schoolboys as "the devil in the bottle"? This toy is a bottle filled with water, in which is contained a small hollow image, which image can be made to sink or float in the water, or even to remain suspended half way between the surface of the liquid and the bottom, by manipulating a diaphragm closing over the neck of the bottle. A recent controversy leads me to these questions. A. The submarine and the "devil in a bottle" are instances of the application of Archimedes's principle. The little imp in the bottle is known in science by the name "Cartesian diver." Archimedes stated the principle that a body immersed in a liquid loses as much weight as the weight of the liquid it displaces. If the liquid displaced weighs less than the body, the body sinks; if it weighs more than the body, the body rises and floats partly out of the liquid; if it weighs the same as the body, the body neither sinks nor rises, but remains just where the weight of the displaced liquid is exactly equal to the weight of the body. The Cartesian diver has a little opening into the lower part of its body. When pressure is put upon the air in the top of the bottle, that pressure is transmitted through the water in the bottle to the air in the imp, and compresses the air so that water flows into the imp and makes it heavier. It then sinks. By relaxing the pressure, the imp may be stopped at some point and kept there. If the pressure is however maintained as at first, the imp sinks to the bottom without stopping, since the water has the same density in all parts of the bottle. The submarine is intended to act upon exactly the same principle in the same manner. They usually do so, but once in a while one continues to the bottom, with disastrous results to all on board. The steel ball, which you suppose, would do exactly the same as you state, if it could retain its volume unchanged, and displace a cubic foot of water at a depth such that its weight were exactly the same as that cubic foot of water. But this is not possible. Under the pressure of the water as it sinks the steel will be compressed more than the water, as we showed, even if it were solid, and when it reached the theoretical depth its volume would be less than a cubic foot and it would sink still farther, and be compressed still more till it reached the bottom. There is no place such as you suppose. There is still another impossibility. A steel ball whose volume is one cubic foot and whose weight is 65 pounds must be made of steel plate about a third of an inch thick. This would be in worse shape than the proverbial "cocked hat" long before it reached a depth of 10,000 feet, by the pressure of the water.

NEW BOOKS, ETC.

The Stone Implements of South Africa. By J. P. Johnson. 258 illustrations. New York: Longmans, Green & Co. 8vo.; cloth. Price, $2.50.

There is much work to be done in investigating the prehistoric races of South Africa, and in fixing them in their proper places as regards their advancement. Mr. Johnson has collected some interesting material, but it is to be hoped that he will find opportunity to investigate more thoroughly the ground that he has broken. However, his reasoning is quite in accordance with the facts, and places his finds beyond doubt in the periods to which they belong.

A Pocket-Book of Mechanical Engineering. Tables, Data, Formulas, Theory, and Examples for Engineers and Students. By Charles M. Sames. Revised and enlarged. Published by the author at 542 Bramhall Avenue, Jersey City, N. J. 195 pages, 41 figures; flexible leather. Price, $2.

The author has increased the scope of his first edition, adding much valuable matter, without adding materially to the bulk of the book. As a pocket reference book it cannot be too highly recommended. The field covered is extensive and closely covered, yet there are no unnecessary facts to hinder the practical worker.

The Coast Manual of Lettering and Designs. Los Angeles, Cal.: The Coast Manual Publishing Company. Quarto; cloth; 106 pages. Price, $5.

Now that advertising is accepted without hesitation as a vital part of commercial routine, a book of letterings and designs, selected especially for their value to the "display artist," will find the readiest appreciation. The handbook published by Fred Knopf and J. M. Mahaffey is full of successful combinations that will be found most serviceable in their promptings to the experienced designer as well as to the novice.

Modern American Machine Tools. By C. H. Benjamin. New York: E. P. Dutton & Co. 8vo.; cloth; 134 illustrations, 320 pages. Price, $5.

The object of this treatise is to show to the buyer and user the prominent characteristics of modern machine tools as now manufactured in the United States, the various points in which they differ, and some recent data as to their capacity and performance.

To the buyer in Great Britain or on the Continent, this work should be a help, as it brings together in one volume facts from a variety of sources and furnishes information which might otherwise need to be sought at much expenditure of time and trouble.

While the present work is in no sense an advertising medium, it illustrates as large a variety of machines and of makes as the space allows, giving the reader as comprehensive a view as possible, and in all cases allowing an uninfluenced opinion to be formed.

Alternating Currents. A Text-Book for Students of Engineering. By C. G. Lamb. New York: Longmans, Green & Co. London: Edward Arnold. 8vo.; cloth; 325 pages, illustrated. Price, $3.

Many treatises on this subject have been written, but Mr. Lamb's work fills the need for a text-book for beginners that without being too cumbersome covers the subject of alternating currents in all its aspects.

The treatment of the question is based largely on the use of vectors, supplemented by simple analytical methods when it is desired to obtain numerical results. The symbolic treatment does not appeal to students, and has for that reason not been used. Also no attempt has been made to distinguish in the formulæ whether absolute or practical units are employed, since the unwieldy results are perplexing to beginners.

Space and Geometry in the Light of Physiological, Psychological, and Physical Inquiry. By Dr. Ernst Mach. From the German by Thomas J. McCormack. Chicago: The Open Court Publishing Co. London: Kegan Paul, Trench, Trübner & Co., Ltd. 12mo.; cloth; 148 pages. Price, $1.

The three essays which form the present volume were written for the Monist some four years ago. Last year they were in great part incorporated in their original German in Prof. Mach's latest published work, "Erkenntniss und Irrthum; Skizzen zur Psychologie der Forschung." In them Prof. Mach discusses the questions of the nature, origin, and development of our concepts of space from the three points of view of the physiology and psychology of the senses, of history, and of physics, in all of which departments his profound researches have gained for him a most exalted position.

Small Electrical Measuring Instruments. How to Make and Use Them. By Percival Marshall. New York: Spon & Chamberlain. 12mo.; paper covers, 90 pages, illustrated. Price, 25 cents.

A clearly-written and freely-illustrated handbook for the experimenter and investigator. By its use many instruments of equal efficiency to those sold by the regular makers can be made at very low cost.

MODERN PLUMBING ILLUSTRATED. By R. M. Starbuck. Fully illustrated by fifty full-page plates made expressly by the author of this work. New York: Munn & Co. One large 8vo. volume; cloth; pp. 392. Price, $4.

The purpose of this work is to demonstrate in the most practical manner the best modern practice in plumbing and water supply. There is an abundance of useful information in reference to the kinds of plumbing materials and fixtures and the installation of these for the modern cottage, or the more pretentious house, apartment house, hotel and office building. The purpose of this work is to demonstrate by liberal scale drawings, which cover almost every imaginable condition likely to come before the plumber, architect, and sanitary engineer. The book will be found valuable to the plumber in his actual work, giving special details as to size and weight of pipes required under different conditions. To the architect it will be found suggestive and will aid in preparing plans and directing and superintending work; to the owner in aiding him to secure the best and simplest systems for his building; to the plumber inspector the many practical features it presents will remind him of the methods to be pursued to secure safe and healthful sanitary conditions, and to the plumbers, practical methods of executing the work. The book presents, in a word, the latest and best modern practice, and should be in the hands of every architect, sanitary engineer and plumber who wishes to keep himself up to date in this important feature of construction.

A TEXT-BOOK OF SANITARY AND APPLIED CHEMISTRY, OR THE CHEMISTRY OF WATER, AIR, AND FOOD. By E. H. S. Bailey. New York: The Macmillan Company. 12mo.; cloth; 345 pages. Price, $1.40.

Although some knowledge of chemistry is necessary for a thorough assimilation of the present work from the theoretical standpoint, the layman will find it unusually instructive. Chapter I. treats of the "Atmosphere," its composition and the impurities affecting it. Chapter II. deals with "Fuels," and Chapter III. deals with "Heating and Ventilation." Chapter V. on "Water," and Chapter VI. on "Purification of Water Supplies" are highly important. The rest of the book is devoted to foods, etc. As a whole, the work is concise, well written, and not too technical to be of universal value.

GLUE HANDLING. Part I. Twelve Chapters of General Information. By Friman Kahrs. East Haddam, Conn. Price, $1.

A handbook of value to all glue users, being the result of the author's observations during his eighteen years of experience as a glue expert. It is too bad, however, that such an excellent work should have its attractiveness, if not its usefulness, lessened by the introduction into the text of matter of a purely advertising nature.

SOME CITIES AND SAN FRANCISCO AND RESURGAM. By Hubert Howe Bancroft. New York: The Bancroft Company.

An interesting comparison of San Francisco and the late disaster with other cities and the calamities that have befallen them. Every line is full of the local pride and confidence that go so far to make up the body of American patriotism.

INDEX OF INVENTIONS

For which Letters Patent of the United States were Issued for the Week Ending April 30, 1907.

AND EACH BEARING THAT DATE

[See note at end of list about copies of these patents.]

Acid cooling and generating chamber, I. P. Lihme	852,390
Advertising device, H. F. Eckersberg	852,170
Aerial vessel, T. Orgren	852,292
Aeroplane, navigable, B. F. Mickley	851,683
Agitator, F. W. Gowan	852,114
Agricultural implement, P. Petersen	851,959
Air brake apparatus, R. J. Wilson	852,007
Air brake system, D. M. Daley	852,108
Air brake system and engineer's valve, G. Macloskie	851,818
Air purifying apparatus, J. H. Kinealy	852,122
Air ship, J. C. Reckweg	852,239
Alarm mechanism, automatic, C. Breiland	851,915
Alloys, producing low-carbon ferro, E. F. Price	852,347
Amusement apparatus, N. G. Warth	852,149
Amusement device, W. T. Watson..852,248,	852,308
Anchor, sea, F. Rouse	852,201
Animal trap, O. H. & F. H. Voelkerding	851,716
Animal trap, J. Wolf	852,009
Ankle supporter, R. F. Le Mat	851,950
Anti-skidding device, J. M. M. Blanchard	851,857
Apparel, C. R. De Bevoise	852,262
Automatic brake, J. J. Muller	851,766
Automatic switch, J. Hency	851,935
Automobile controlling means, H. Lemp	851,762
Axle stub, Detar & Schoonover	852,169
Bag holder, M. E. Eagleton	851,873
Baking pan, E. Morrow	851,826
Bale of fibrous materials, H. L. Duncan	852,015
Baling press, W. F. Truelsen	851,714
Baling press, L. P. Agnew	852,252
Banded stave pipe, J. S. F. Marks	852,336
Barrel trussing and hoop driving machine, J. B. Stanhope	852,040
Battery. See Dry battery.	
Bearing, centrifugal separator, C. H. Shaw	852,203
Bearings, ball holding ring for ball, S. Schneider	851,697
Bed, N. S. Stein	852,041
Bed bottom, G. Bezanger	852,255
Bed, folding, J. M. Wilfley	851,910
Bed, spring, W. F. Ade	851,911
Bedclothes fastener, A. M. Hoffman	852,180
Bedstead, folding, F. Wood	851,724
Beehive, C. P. Harmison	851,882
Beer coolers, locking device for, M. D. Sadtler	852,140
Belt, abdominal, Knight & Davis	851,889
Belt cutter, R. T. More	852,340
Belt, life, A. & E. Gareis	851,740
Belt thrower and guide, J. L. Coutts	851,652
Binder, loose leaf, W. M. Raynor	851,693
Binder, loose leaf, J. Strang	852,084
Binder, loose leaf, P. Revere	852,139
Block signal system, automatic, Patenall & Dryden	851,692
Boat, G. A. Farini	852,380
Boats, device for locating and raising sunken, Slattery & Sambur	851,698
Bobbin clutching device for spindles, C. A. Hawes	851,884
Bobbin holder, F. Pope	851,774
Body bolster, C. F. Huntoon	851,753
Boiler cleaner, steam, F. G. Rogers	851,694
Boiler water purifying device, steam, W. P. Weimann	852,005
Bolster, A. Lipschutz	852,391, 852,392
Bolt cutter, stay, E. T. Strong	852,302
Boot calk, C. Pfeiffer, reissue	12,644
Bottle holder, J. T. H. Paul	852,345
Bottle, non-refillable, M. P. Niendam	851,896
Bottle, non-refillable, G. V. Doherty	851,925
Bottle, non-refillable, A. B. Court	852,260
Bottle, non-refillable, H. O. McClurg	852,408
Bottle stopper, E. C. Leach	851,990
Bottle stopper, A. E. Redlich	852,242
Bottle, syrup, W. R. Warner	852,360
Bottle washing machine, C. H. Loew	852,127
Bottles, capping, H. L. Fulenwider, et al	852,323
Box ending machine, automatic, P. L. Smith	852,083
Bracket, J. Hilbert	852,179
Brake, W. H. Lewis	851,892
Brick kiln, E. Weiss	852,404
Broom, R. Rosenbaum	852,244
Broom machine, C. Clemens	851,916
Brush holder, R. E. Barker	851,793
Bucket scraper, orange peel, L. A. Desy	851,733
Bucket scraping attachment, J. T. Boyd	852,256
Bureau, P. Ramminger	851,834
Burglar alarm relay drop, D. D. Friedman	852,226
Burial case, J. F. Russell	852,080
Bushing, self-oiling, Perkins & Jenney	851,958
Button, hose supporter, E. Cleary	851,980
Cable chain connectng means, A. Frankenheim	852,264
Cable clamp, A. H. Meech	851,822
Cake machine, G. S. Ward	852,208
Cane loader, J. B. Gaussiran	852,267
Car brake, automatic, C. Fero, Jr	851,874
Car construction, W. G. Thummel	852,049
Car fender, J. P. Rohn	851,9[illegible]
Car signal, P. D. Malloy	852,2[illegible]
Car stake, F. V. Carman	852,167
Car vestibule, J. Krehbiel	851,945
Car wheel fender, J. F. Sargent, Jr	851,965
Cars, pneumatic appliance for, G. H. Hollingsworth	852,117
Cars, steam-heating system for railway, E. E. Gold	852,019
Carbureter, A. Kunkel	851,759
Carding machine, M. A. Kehoe	852,330
Carpet beater, O. O'Halloran	852,195
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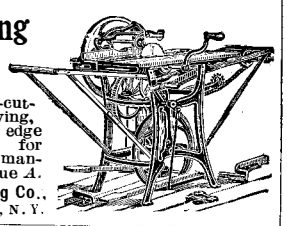

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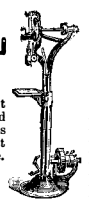

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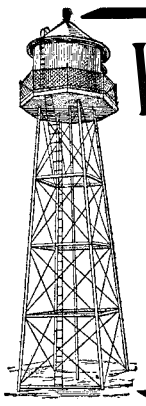

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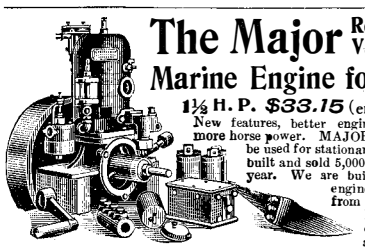

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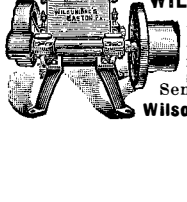

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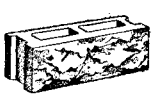

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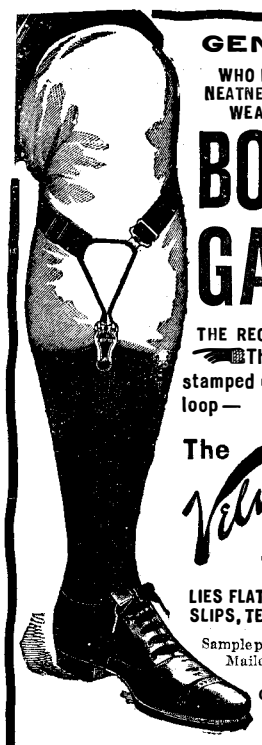

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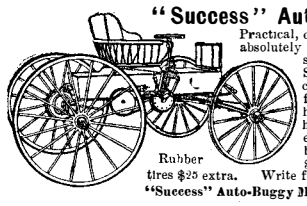
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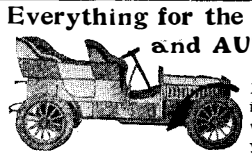
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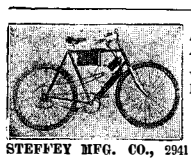
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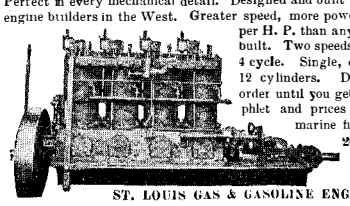
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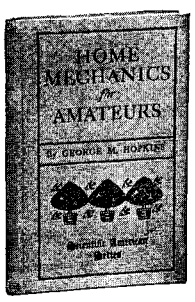
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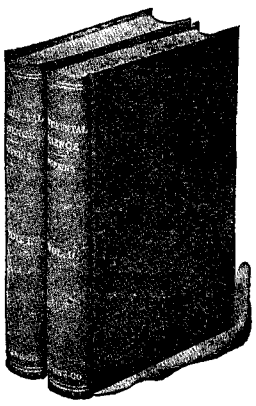

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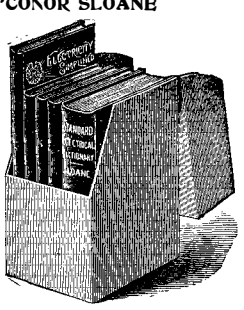
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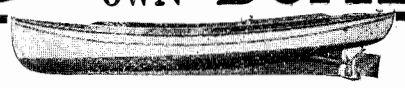

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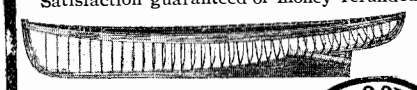

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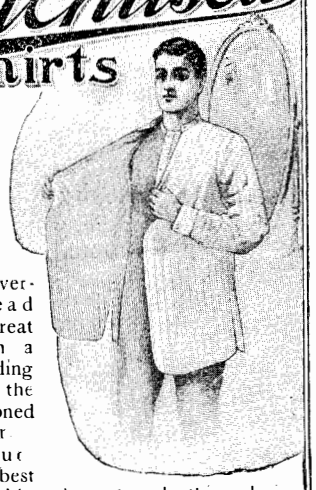

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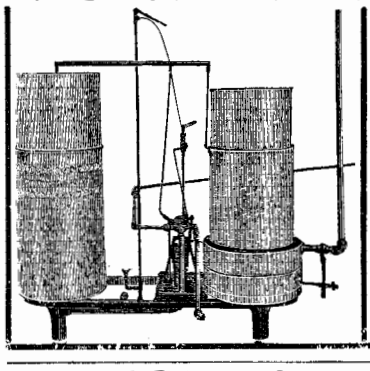

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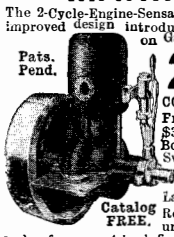

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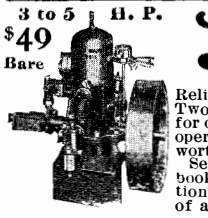

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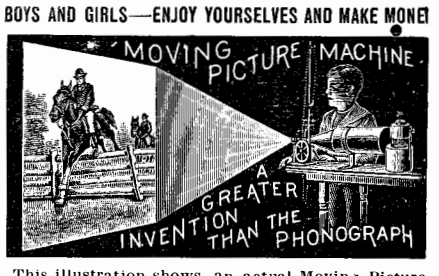

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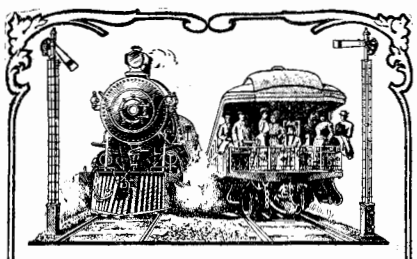

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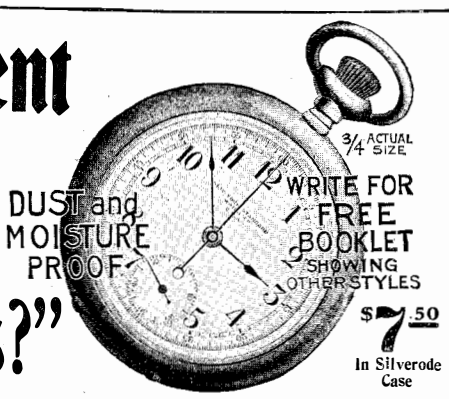

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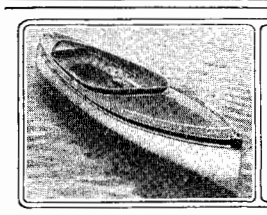

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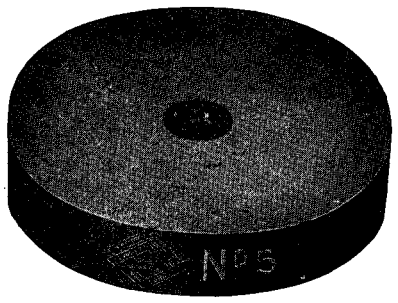

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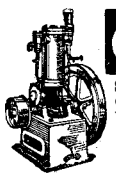

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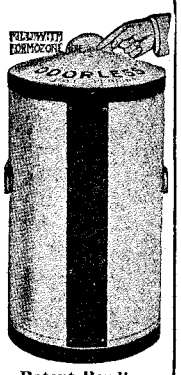

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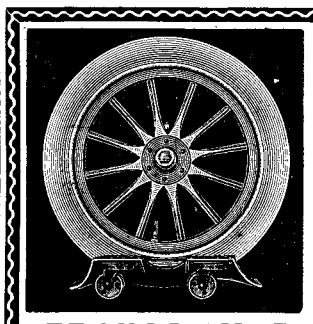

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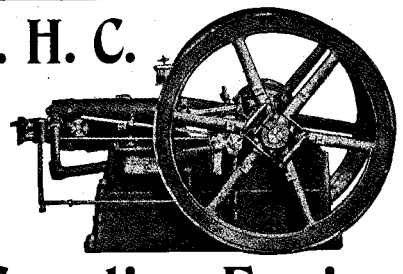

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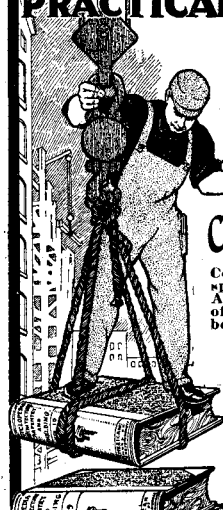

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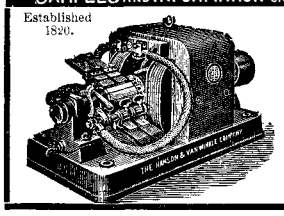

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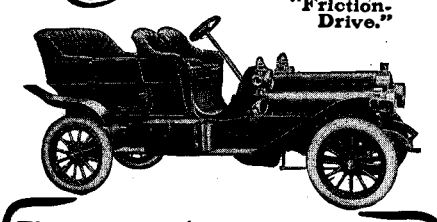

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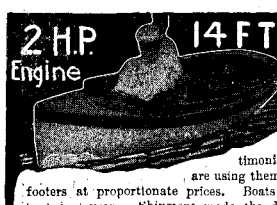

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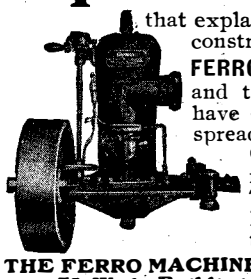

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